THE

ELECTRICAL REVIEW.

VOL. LXXII. MARCH 7, 1913. No. 1,841.

ELECTRICAL REVIEW.

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THE ENDS OF THE RAINBOW.

DURING the past year, in connection with the electrical industry, a fact has again been noticeable which has from time to time recurred in a striking manner. Concurrently with the reports of abundance of work and general signs of progress everywhere, the statement has been persistently made that the wages to skilled employés have been low. For proof of this statement one has only to turn to the "Correspondence" columns of the ELECTRICAL REVIEW and note the comments which have been made upon the salaries of central-station assistants.

This raises an important problem in the economics of the electrical industry, and indeed of most modern branches of skilled labour, and without in any way professing to discover a remedy, it may be advisable to emphasise truths which have before been enunciated in these columns. To do so we may venture to use a metaphor even at the risk of the accusation of poetical tendencies. Where a complete rainbow is seen, certain portions of the landscape at its beginning and end are apparently transfused with a peculiar glamour caused by the prismatic effect of the light coming from that direction. In the same way, we venture to say that those portions of industrial activity which correspond with the beginning and end of the developmental period of a branch of industry, present features of unusual interest that draw particular attention, and as the tendency to run in masses is a human instinct which is almost irresistible, we observe great quantities of promising material gravitating either in the direction of the initial stages of a new branch of industry or to the opposite pole when the industry becomes stereotyped. In both these directions lie the fewest opportunities; the greatest opportunity lies in the somewhat humdrum region intermediate between these two extremes, when prosaic development is actually and steadily in progress.

We believe this fact to be so important that we think it worth while to insist upon it a little further, and in doing so we will deal first of all with the initial stages of the development of an industry. It is hardly necessary to remind our readers that fortunes have been repeatedly lost in experimenting. As one somewhat cynical authority has stated, "First steps are the most dangerous, because they are usually taken innocently." There is, however, a great temptation, immediately a new form of industry appears to be developing, to get into the new movement as quickly as possible, regardless of the fact that unforeseen and unestimated dangers lie in front which may wreck the most promising career. Even at the present day we believe we are correct in saying that the aeroplane industry, which is so new that it cannot be called fully standardised, and has hardly reached the point of commercial utility, has become swamped with young men tendering their services at nominal wages, and even offering premiums in view of advantages

which they may reap if they succeed in reaching a decent post in the problematic future.

Turn to the other extreme. It is equally fatal to enter a profession when that profession has become a stereotyped affair. During the days of the renaissance of learning, the term "clerk" was one that signified culture and deep reading. It was a title of honour. In the present day, when free education has turned its myriads into poorly paid office positions, the term "clerk" has been shorn of much of its dignity. It is a well-known fact that in most of the older professions, in which there are no new developments and which are reckoned respectable and safe, the entrant pays for his respectability by having to wait for dead men's shoes. There is probably not to be found in the whole country a more respectable, hard-working and intelligent body of skilled men than in the banking profession. On the other hand, the salary received by a bank clerk for a very considerable part of his life is notoriously low. These are used as illustrations of the principle that we are trying to lay down that after the stage of development has passed, it is a mistake to enter a profession with the idea of making money. In engineering we have the case of the central electric power station, which is nowadays to a very large extent a standardised production. Hence, in very many cases (with notable exceptions), wages are low on the part of the operating staffs. Where dissatisfaction as to remuneration occurs, it is worth while ascertaining whether on the one hand the industry referred to is in its pioneering stages, or on the other it is in such a state of standardisation that there is no room to move.

We have laboured these points somewhat, because it is necessary to drive home the truth that the greatest chances of success are in the intermediate stage of steady development, and unless a man can get into some employment where such development is proceeding, he stands a minimum chance of success. It is even better, rather than to go into a pioneering industry too soon, to go into an old industry with a new training. For example, it is quite conceivable that a bright engineering student with a thoroughly good grasp of mechanical principles and up-to-date methods of doing work would make a success financially of such an old-established branch of mechanical engineering as ordinary mill-wrighting work, provided that he brought to bear upon that old profession modern methods. In other words, success, as a rule, in an engineering career depends on doing an old thing in either a better, a quicker, or a cheaper way, and it is here that the prosaic stage of development of industry lies. Here it is also that the money is to be found.

We would like to leave the subject at this point. Readers who examine the argument will find in practice a large number of instances of the truth of the principle laid down, and as nothing is more important to a man than a clear idea of his objective, it has been considered worth while to put forward these remarks, not in a dogmatic spirit, but in order that they can be thoroughly discussed. It is pitiable at the present time to see the enormous waste of good material which is going on among the personnel of engineering activities. Many a good man has been stifled through being in the wrong place, and the reason for his being in the wrong place has been that he has attempted to make his fortune at the ends of the rainbow instead of steering for the middle region.

Constantinople Electrical Schemes.

It is advisable that the fact should not be overlooked that the recent grant of a concession for the construction of an underground railway in Constantinople forms part of an international combination for the amalgamation of certain interests in the Turkish capital, which has been proceeding for some time past. The combination, which is specially attributed to the efforts made by the Belgian Société Financière de Transports and the Banque de Bruxelles, bears the title of the Consortium de Constantinople, with headquarters at Brussels, and its technical management is, or was, in the hands of the Société Financière de Transports.

As will, perhaps, be remembered, the Consortium or its associated group already owns the Constantinople tramways, which have been converted to electric traction; the Galata-Pera tunnel railway, which was purchased from an English company; the Stamboul Gasworks; and the Ganz electric lighting concession. The addition of the proposed underground electric railway from Taxim to Bajadiz apparently completes the schemes, which are expected to involve an expenditure of £3,600,000. At least, this is the total share and loan capital which was nominally subscribed a few months ago by the numerous members of the Consortium, which is led by the Deutsche Bank. One portion of the capital has been formed by the assets brought in by the tramways, gasworks and lighting concession, whilst the remainder has been subscribed by four subsidiary groups. Besides the Deutsche Bank, the German list contains the names of 15 other financial institutions, including the Electric Light and Power Investment Co., of Berlin, and the Electrical Enterprises Co. of the same city. The Belgian group contains 11 names, inclusive of those of the two banks previously mentioned; the French group also comprises 11 names, of which the Imperial Ottoman Bank, the Banque de Paris, Comptoir National and the Compagnie Française Thomson-Houston may be cited; whilst Switzerland is represented by the Zurich Bank for Electrical Enterprises and the Swiss Credit Anstalt. It has, however, to be borne in mind that the Consortium is merely a preparatory syndicate for the Union Ottomane, Société d'Entreprises Electriques à Constantinople, which was formed last September, and which will presumably be required by its interested group to proceed with the construction of the underground railway when circumstances are favourable.

The fact that the railway concession has been entrusted to the Consortium is not particularly new in itself, as it was reported last autumn that the Consortium would be victorious over the rival scheme which was promoted by the French Omnium group, headed by the firm of Perrier & Co. As affairs now stand, the Germans expect to receive a considerable portion of the orders for the execution of the work, whilst the balance may be the share to be allotted to French and Belgian works.

Manufacturing in Russia.

According to reports circulating in interested circles in Russia, the electrical manufacturing companies of German origin in that country, in which Teutonic capital of considerable amount is invested, experienced very favourable working results in 1912. On the one hand, it appears that quite a number of central stations were carried out in different towns, in consequence of the municipal authorities being able to raise loans for the purpose, and several of these loans were floated in England. The latter cases, therefore, represent further examples of British capital being advanced in order to provide contracts for German works. On the other hand, extensive orders were placed with the electrical firms by manufacturing works in which the use of electric light and power is being extended, and the long-expected orders from the Government authorities also provided good employment.

A further step in connection with the consolidation of the foreign undertakings in Russia is in contemplation. Several years ago the Helios Co. was compelled to suspend its

Russian branch, and a little later the separate cable departments of three works were combined in the form of the United Cable Works Co. Now the Russian Siemens & Halske Co., which has a share capital of £560,000, is to be merged into the Russian Schuckert Co., whose share capital amounts to £300,000. It was only in 1912 that the latter company made an issue of £100,000 for the purpose of defraying the expenditure incurred on extensions of works, and thus advanced the total to £300,000. The dividend paid in 1909-10 and 1910-11 was 4 per cent. for each year, and 5 per cent. was distributed for 1911-12. On the other hand, the Siemens & Halske Co. paid 5 per cent. in 1909, 5 per cent. in 1910, and 6 per cent. in 1911. This company has also made large extensions of works in recent years, and has developed its scope of activity by participating in various undertakings.

The combination of the two companies, which takes the title of the Russian Siemens-Schuckert Works, found its counterpart in the case of the parent undertakings in Germany a few years ago. It is intended to be carried into effect by increasing the share capital of the Schuckert Co. by £1,200,000 to £1,500,000, and the object is to facilitate financially the solution of the lighting, power and traction problems arising in that country. The Russian Allgemeine Electricity Co., which is the only remaining German manufacturing company of importance, now has a share capital of £1,200,000, of which the sum of £400,000 was issued last November. The rate of distribution paid was 6 per cent. in 1909, 7 per cent. in 1910, and 8 per cent. in 1911, whilst from 9 to 10 per cent. is expected for 1912.

Electric Cooking.

The paper read before the I.E.E. by Mr. Wilmshurst, which we abstract in this issue, and the interesting discussion which followed, are welcome indications that the subject of electric cooking is now receiving serious attention at the hands of central-station managers. It will be noticed that there is general agreement on the necessity of letting out the larger apparatus on hire, a proposition which we have frequently supported; there is no doubt at all that that is the method which has enabled gas suppliers to develop their cooking load to such an amazing extent within the last 10 years, and there is no other way to do it. As we have pointed out, this involves the manufacture of electric cookers in quantity, on standard lines, and at the lowest possible cost. Those firms which realise the need and lay themselves out to meet it satisfactorily will be the firms to profit by the developments which will follow. So long as the manufacturers wait for the demand before making the plunge, and the would-be users wait for the reduction in price, we are merely travelling in a "vicious circle," and no progress can be made.

We are glad to note that the design of the heating elements—the crux of the problem—is steadily improving, and that want of reliability no longer avails as a serious argument against the use of electric cookers. The remarkable guarantees that some makers are now prepared to give with their heating elements sufficiently indicate the advance that has been made. The importance of standardisation will make itself felt more and more as electric cooking becomes more popular, and makers ought to give close attention to this subject, though at the present stage of evolution it would be premature and ill-advised to attempt to formulate rigid standards. However, each maker can at least see to it that his own products follow some systematic order, which will enable users to replace parts of their apparatus at any time at the minimum of expense.

We believe that the splendid pioneer work that has been, and is being, done by the gas suppliers not only affords most valuable guidance to electrical men, but is of direct service to the electric cooker, for the public, having learnt to appreciate the convenience and efficiency of the gas cooker, will find it a short and easy step onward to the greater convenience and efficiency of the electrical apparatus, which is free from the offensive fumes and dirt which, beyond question, are the usual accompaniments of a gas cooker.

HINTS FOR ELECTRICIANS.

By E. A. BELCHER.

It very often happens that the electrician in charge of a number of motors finds, on testing a direct-current motor with a Megger, that the armature has developed a bad earth.

As very few have the advantage of a supply of alternating current to turn to, the following tip may prove of use; the writer has been able to locate and repair faults, thereby saving an enormous amount of valuable time and expense, when otherwise there would have been no alternative but to return the defective armature to the makers, thus stopping machinery for an indefinite period and incurring the wrath of his employers for not being able to effect a repair, as half of them cannot understand what is wrong, when to the eye nothing appears amiss.

Having removed the armature from the frame, proceed as follows:—Connect up wires to armature as in fig. 1, having in circuit a low-reading voltmeter; the writer uses a central-zero cell-testing meter. Put a lamp of small candle-power

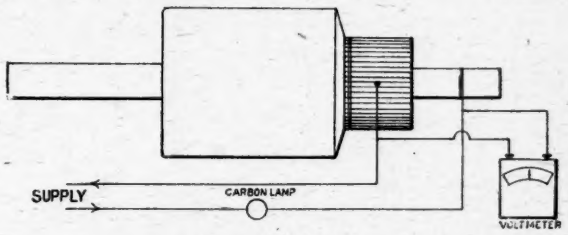


Fig. 1.

into holder (this is essential, as using too big a lamp may spoil the low-reading meter, if by any chance the wires are removed from the commutator). The writer uses a 16-c.p. carbon lamp on a 200-volt circuit.

Mark the segment on which the wire is placed, and switch on current, when a certain reading will show on the voltmeter; move the wire round the commutator one segment at a time, and note the readings. Continue doing this until you find a segment or segments which give no deflection on the meter; this will be the end of the coil on which the earth is situated, and having ascertained this, it will be comparatively easy to find the exact spot.

It will be readily understood that connection is made from the spindle through the fault and through the coils to the segment; there will be a drop in volts in proportion to the size of the lamp used, and the nearer the wire is moved

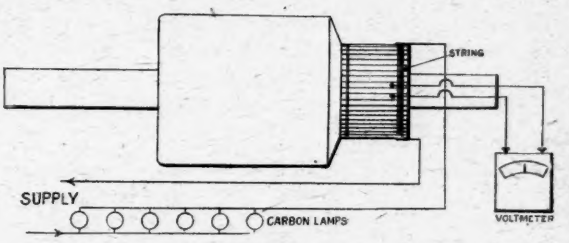


Fig. 2.

towards the coil which is earthed, the less will be the drop in volts, until the faulty coil is reached, and no reading is indicated on the meter.

To find either a broken connection or a short-circuited coil proceed as follows.—

Connect the armature up to any supply, as shown in fig. 2, fixing the wires to the commutator directly opposite one another by means of a piece of string tied tightly round it. Take a cell-testing voltmeter and find the voltage drop between two adjacent segments; if the meter does not show a big enough reading, put in more lamps. The writer uses six 50-c.p. carbon lamps on a 200-volt circuit. Continue testing round, in like manner, segment by segment, until a plate is reached which shows no deflection on the voltmeter, or a very decidedly lower reading; this segment will be the end of the faulty coil if short-circuited. On the other hand,

if there is a disconnection in a coil, the readings in the faulty half of the armature will be *nil* until the faulty coil is reached, when a large reading will be obtained.

The writer has had considerable trouble with various motors to get them to run sparklessly, but has effected a cure in some really bad cases in the following manner :—

After the commutator has been turned and ground, procure a hack saw blade with teeth set to as nearly as possible the width of the mica between the segments ; fit over the back of the saw, the whole length, a piece of sheet-iron in order to stiffen it, and with this cut out the mica to about $\frac{1}{32}$ in. below the level of the commutator surface. As the commutator gets slightly scratched, finish it off by polishing with a very fine piece of emery cloth. The above does not take so long as many may anticipate, and any intelligent labourer can be easily instructed to carry out the work. The writer is in charge of over 40 motors of various horse-power, and has found the above tips very handy in time of need. No novelty is claimed for them.

THE FUTURE OF BRITISH ELECTRICAL INDUSTRY IN NORTH CHINA.

By HSI C'HUNG CHI.

Every engineer who has lived in the North of China for any length of time will be painfully aware of the total lack of energy displayed by British manufacturers in placing their plant and material within reach of the Chinese. With the exception of one firm in Tientsin there is no British manufacturer who has had the enterprise to send a representative here to open an office and get in touch with the big contracts which are now frequently being let. All through the slack time during the revolution the Germans have been organising their methods of business, with the result that it is virtually impossible for British firms to compete with them.

It is of no use to quote the Chinese for engineering material unless prepared to do so delivered with all charges, duty, &c., paid, in good condition at the customer's go down, and there is no British firm in North China which is able to do so. If material is bought f.o.b. London against bills of lading, it is very likely lost during transhipment at Shanghai, and it is necessary in the case of material for towns such as Peking arriving at Tientsin, for someone to journey to the port to clear it through the Customs and put it on the train.

On the other hand, the German engineering firms are perfectly organised both at Peking and Tientsin, having a staff of commercial and technical men who are able to advise the Chinese, quote prices, deliver samples with their tenders *viâ* Siberia (a benefit which our Postmaster-General considers quite unnecessary), and see their cargo through to its destination, taking back all damaged material.

In the future, nearly all large Government contracts will be decided in Peking, and, under the present conditions, British firms have no earthly chance against the large German ones.

Another fatal error of our manufacturers is their treatment of would-be Chinese engineering students, and a pamphlet has been circulated in North China with the idea of inducing (?) the Chinese to send their sons to England to learn their profession.

Most of the Chinese that I have met who wish their sons to have an engineering education have selected England or America, as English is still the leading foreign language amongst the Chinese, and most of the boys learn it in the secondary schools here, but the idea of spending £220 a year for each boy puts it entirely out of the question. On the other hand, the Germans are encouraging Chinese apprentices in every way they can, and the large Berlin firms will accept apprentices from good families, pay their railway fares to Germany, article them for five years without a premium, and pay them a living wage of, I think, 10,000 marks for the five years.

In return for this when the men come back to hold good appointments, they have a full knowledge of the German language and of German plant and machinery, with a result that they recommend the purchase of German material which they understand in preference to British which they do not.

This is a matter which ought to have the serious consideration of the new British Engineers' Association, but all we have heard of that august committee of gentlemen up to the present is a great deal of after-dinner talk. If this association is to do any real good, the absurd subscription of £10 per firm per annum will have to be very considerably increased, as even if 100 firms subscribe, the revenue will be quite useless to achieve any object here.

Mr. Beilby Alston, of the Foreign Office, came out here about six months ago, but no one seems to know what good he did, as three-quarters of the engineering fraternity had no opportunity of meeting him and expressing their views. It is true that the Tientsin Englishmen gave him a dinner the day before he went away, and hoped to hear something on that occasion about future prospects for British trade, but they were disappointed, as the matter was hardly alluded to.

In conclusion, I would repeat that North China electrical engineering is almost entirely in the hands of the Germans, and it will require a great deal of enterprise to regain for British manufacturers what they have already lost through indifference and lack of enterprise.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Testing the Continuity of Earth Conductors.

Mr. Davis is correct in saying that each set of conditions should be considered separately. Referring to the bridge test, what I mean is this : Suppose I want to take a test in a section where haulages, conveyors, coal-cutters and pumps are operating, one or other, over the whole 24 hours, then arrangements for clearing switches, &c., and, perhaps, short-circuiting a mile inbye, take, say, 15 minutes, test 5 minutes, arrangements for switching on 10 minutes, = half-an-hour, or 15,000 gals. on a 500-gal. pump, walls unstripped, or a train of coal left at the pit bottom at the day's end. His "volt drop" test is only applicable where direct-current is available.

I agree with him that it would be best to use a fairly heavy current for testing, where this can be done, with alternating currents ; it would be interesting to get at the "choking" effect of a tape or wire armouring. The former is spirally wound and would have a higher value than the latter, which is placed on with a lay or twist. This, however, presents no difficulty with a small testing transformer having a variable low voltage secondary.

Would Mr. Davis or "Continuity" be inclined to include this in the final result called for under Rule 8 (b) or Rule 12 (e) ? I think this would be a proper test to apply with the other.

Individual conductors are mentioned under Rule 8 ; individual cables under Rule 12. What about the total result, with joints, cross bonds, tee connections, &c., all in series ? ·1 ohm often means a big difference, or even ·05 ohm, on a large conductor.

Again, are we bound down to operating at 1,000 amps. to the square inch ? The I.E.E. standard makes a considerable difference on the smaller sizes. This increases the volts drop on the armouring in the event of a fault, when the current is flowing.

It would simplify matters if Mr. Davis and Mr. Field would agree with me that it is practically impossible to have a fracture on the armouring of a three-core double-armoured cable, protected against corrosion. "Continuity" does so in his last letter.

I have seen the cables crushed flat many times, and the copper conductors almost severed, but never yet have I seen the conductivity of the armouring seriously impaired. Would Mr. Davis note that the Home Office do not consider

any other regulations but their own. I know, however, that B. of T. regulation 5 (*b*) is the rule aimed at.

Perhaps "Continuity" has got into two separate geological "pockets" with his earth-plates. As an experiment, he should try the effect of pouring a few pailfuls of dilute sulphate of copper (a good handful to a pail of water) along the ground between his plates, and test after a few days. I ask him not to use soda or other alkaline matter.

Although I stated in my last letter that the Home Office set a definite value, theoretically, on the armouring and earth conductors, I still maintain that Rule 14 calls for no measurement. If the "electrician," as defined by Rule 14, makes a test to prove efficiency under Rules 8 and 12, he proves *continuity* under Rule 14.

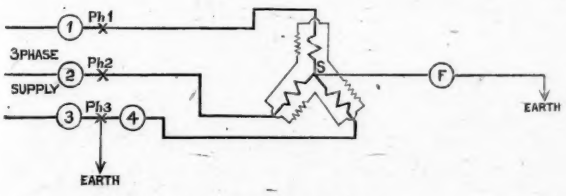
John P. C. Kivlen.

Uddingston West, *March 1st*, 1913.

Earthing the Neutral.

In reply to Mr. Kenelm Edgcumbe's letter of February 11th, I would point out that there is not any limiting resistance in the earthed neutral other than the transformer itself. Below is a series of readings taken, which show the conditions under which the transformer works when a fault occurs.

Trans. 3—2 k.v.a., Ratio 200 to 2,000, Delta Connected on h.t. Side and Star on l.t. Side, as shown in Sketch.



Current readings.					*Pressure readings.*						*Remarks.*
1	2	3	4	F	1&S	2&S	3&S	1&2	2&3	3&1	
0	0	0	0	0	20·5	20·5	20·5	36·25	36·75	36·25	Open circuit.
35·0	17·5	17·5	17·5	50·0	·45	25·0	20·5	25·50	36·50	21·50	Fault on Ph. 1.
17·5	36·0	18·0	18·0	52·0	21·0	·385	25·5	21·25	25·50	35·50	" " Ph. 2
17·0	17·5	35·75	17·5	50·5	26·0	21·5	·375	36·25	22·00	25·0	" " Ph. 3

You will notice from the above test that the currents in the two healthy phases are always one-third of the fault current, and the current in the faulty phase two-thirds.

S. E. Fedden, *Manager.*

Electric Supply Department,
Sheffield, *February 26th*, 1913.

The Electro-Harmonic Society.

As a visitor at the Electro-Harmonic Ladies' Evening at the Holborn Restaurant on Tuesday last, I was very much surprised that smoking was prohibited, although smoking lamps, matches and ash trays were placed on the tables. Surely the ladies would not object to smoking, at any rate, after the interval. I understand that several gentlemen petitioned the Chairman to be allowed to partake of the fragrant weed.

Perhaps this letter may recommend itself to the attention of the Committee of the Electro-Harmonic Society.

Gerald S. Fletcher.

February 27th, 1913.

[We think this letter (which, by the way, seems in very bad taste from a visitor) should have been addressed to the Secretary of the Electro-Harmonic Society. In any case we do not suppose it will have any effect with the Committee, for we have no recollection of a *member* of the Society ever expressing surprise that smoking is prohibited on Ladies' Nights—which, by the way, are not "Bohemian" concerts—during the 25 years or so of the Society's existence. The Chairman, we may add, had to call the attention of several gentlemen to the fact that it was a "Ladies' Night."—Eds. Elec. Rev.]

Cost of Running Small Generating Station.

In further answer to your correspondent, Mr. Gray, I give below the average cost per unit over the last 10 weeks of a small 200-kw. power station driven with suction gas plant. The plant consists of a Kynoch tandem gas engine with a suction gas plant by the same maker, coupled to an E.C.C. generator of modern type. The auxiliaries which take current from the mains before reaching the motor are one direct-coupled air compressor and one direct-coupled circulating pump:—

Average Working Costs over 10 Weeks.

Coal	... ...	·187d. per unit.
Oil, waste, &c.	...	·013d. "
Wages	... ...	·112d. "
Repairs	... ...	·034d. "
Total	...	·346d. "

These figures do not include stand-by losses, which usually amount to an additional 10 per cent. on the total. The load factor is approximately 60 per cent., which is, of course, very favourable.

During the year some extra item of expenditure may be anticipated, which may possibly double the item of repairs.

If your correspondent is interested, I shall be pleased to show him this plant, and give any information that will be of use to him. I may mention the coal costs 28s. per ton delivered to the bunkers.

H. Robinson.

Perry Barr, *February 26th*, 1913.

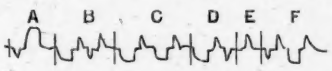
Morse Signalling on Submarine Cables.

With reference to your notice in the Electrical Review of the 28th ult., respecting Mr. Edward Raymond-Barker's article on the Morse sounder in "Submarine Telegraphy," and in view that the following facts may be interesting to your readers, I beg to inform you that the method of operating Morse characters over a submarine cable by inverse or alternating currents is not, by any means, new.

In 1907 I was granted a British patent (No. 16,462) for an invention which embodied the principle of telegraphing over submarine cables in type or roman characters, by means of consecutive alternating impulses.

Whilst constructing this typing system, it was apparent to me that the principle could also be applied to the transmitting of *Morse* characters in the sense implied by the description of Mr. Gott's discovery. An instrument was, accordingly, constructed with this object.

The slip here enclosed shows, beyond doubt, the fact that



I had at that particular date practically established the principle, and obtained Morse characters by consecutive alternating-current impulses (as per Mr. Raymond-Barker's description) for use over submarine cables.

I have submitted these facts for your information, with a view to showing once more that it is possible for two men, entire strangers, to be working on an invention for many years, with precisely the same object in view.

P. O'Neil, *Electrician.*

London, E.C., *March 4th*, 1913.

LEGAL.

London Electric Supply Corporation, Ltd., *v.* Westminster Electric Supply Corporation, Ltd.

This appeal case was last week before the Lord Chancellor and Lord Atkinson, Lord Shaw and Lord Moulton, in the House of Lords. The two companies obtained statutory powers to supply electric energy within certain parts of the City of Westminster. The current supplied by the London company was alternating, and that of the Westminster continuous current. In May, 1910, the two companies entered into an agreement which, in substance, was this: That the Westminster was to work both undertakings, paying the London a yearly sum of about £22,000 The dispute arose in this way: The London said that the position of the Westminster was that of an agent or manager; that the general principle that an agent must do nothing to destroy or diminish his principal's business applied, and that they were bound to supply any customer asking for an alternating current with energy from their (the London's main), and could not push their continuous current upon him instead, nor could they go to a customer, or a prospective customer, and advise him to take the continuous, instead of the alternating current, which he was then taking, or thinking of taking. Mr. Justice Joyce refused to grant the London, the plaintiffs in the

action, an injunction against the Westminster to restrain the defendants from, as it was alleged, acting *ultra vires* to the agreement. The Court of Appeal upheld the decision of the learned Judge. The London Corporation then carried the matter to their Lordship's Bar.

Mr. Danckwerts, K.C., Mr. Buckmaster, K.C., and Mr. J. Austen Cartmell, appeared for the appellants; and Sir Robert Finlay, K.C., Mr. Younger, K.C., and Mr. W. S. Kennedy, represented the respondents.

Mr. Danckwerts, K.C., in opening the appeal, submitted that upon the true construction of the agreement of May 4th, 1910, the Westminster company having assumed the management and working of the London company's undertaking within the Westminster area, came under an obligation to the latter to preserve and maintain that undertaking, and that there was a warranty to be implied from the relation of the parties that the Westminster company would do nothing to destroy, diminish, or injure that undertaking. They could not, therefore, refuse to supply a customer, whether new or old, with electric energy from the London company's supply, nor could they solicit customers who desired an alternating current to take instead a continuous current.

Lord Atkinson: Your case shortly is that the Westminster company are your agents to work your undertaking, and that they have failed to perform the statutory obligation under which you are liable to supply the public generally with an alternating current.

Mr. Danckwerts: Yes, I say that occupying as they do a position as our agents they are bound by the established principle of law that an agent may do nothing which is against the interest of his principal. The learned counsel then went on to say that the course of management adopted by the Westminster must be prejudicial to the interest of the London company.

Mr. Buckmaster, K.C., followed on the same side. He said that the construction which the London company put upon the agreement was in accordance with the powers given by the Electric Lighting Act of 1908, and Sec. 20 of the Electric Lighting Act of 1909; whereas the construction put upon it by the Westminster company made it an agreement which was *ultra* the statutory powers of the parties to enter into. The respondents said, "whether it is *ultra vires* or not, you cannot set up that it is, even on our construction of it, because you have chosen to sue us upon the contract." That was the view which, erroneously as he respectfully submitted, was taken by the Courts below. But the answer to that was this:—"It is not *ultra vires* when properly construed, as we construe it, and so construed the Westminster company have committed breaches, which entitled the London company to an injunction and the declaration as asked."

Sir Robert Finlay, K.C., for the respondents, submitted that the decision of the Courts below was right. The only obligation which the agreement put upon the Westminster company was that of paying the various sums mentioned in the agreement as they became due, and this the respondents had faithfully done.

Lord Moulton pointed out that at some date the City of Westminster Corporation could acquire the undertaking at a valuation of both companies. The quantum of business which the London company was then doing would be important in estimating the sum to be given for that undertaking.

Sir Robert replied that the agreement provided for all that, but the important question was what was the relation created by the agreement? He submitted that the respondents were not managers of the appellants' business in the sense that there was any fiduciary relation between the two. On the true construction of the agreement, the appellants had wholly failed to establish that the Westminster company had committed, or threatened, or intended to commit any breach of any obligation imposed upon them.

Lord Atkinson: In short, do you say that Mr. Justice Joyce was right when, in his judgment, he said the effect of the agreement was to enable the Westminster company to say "We are in a position to supply you with either alternating current or continuous current, but we have, under the Act of Parliament and the rules and regulations of the Board of Trade, a right to say which of the two we will supply"?

Sir Robert replied that that was the construction which he asked their Lordships also to hold was the true one. Later in his argument, the learned counsel said that the object of the Westminster company in entering into the agreement was to promote competition, which would be killed if an injunction such as that sought by the London company, was sanctioned.

Lord Atkinson asked whether starving or strangling the London company to death would promote competition. In such an event there would be one company only, and it could not be said that there was competition then. As it was, customers had a choice, but if there was only one company which offered a supply, that choice would cease to exist.

The Lord Chancellor remarked that it was only natural that a company would say that the article they supplied was the best.

Lord Moulton thought that if Sir Robert's contention was upheld, the Westminster company could diminish the business of the London company by coaxing their customers away.

Lord Shaw observed that if they were free to do that it would enable the Westminster to reduce the receipts of the London to an enormous extent. It was a question of most vital financial importance, and one which was also of vital importance in keeping up the standard of electrical energy.

Mr. Younger, K.C., followed on the same side. He referred to the correspondence between the companies and the Board of Trade. He pointed out that it would be against the interest of the consumer that there should be a double set of mains worked by agreement *inter* parties by the same company within the same area. It would be also to the advantage of the ratepayer, when the time came for the City of Westminster to acquire the undertakings, to have them merged in one complete system.

Lord Moulton: That, I suppose, is how you attempt to justify this policy which must end in practically wiping out the London company.

Mr. Younger did not agree. It was admitted that £100,000 was the very utmost value of the London company's undertaking. It was their capital. Whenever the City acquired the undertakings they were to have all their capital paid them back. If the City gave less than £100,000 for the London company's undertaking the Westminster were to make up the balance. Meanwhile, not a penny piece would the London company be called upon to find, no matter what expense the Westminster had to meet, and no matter how much the demand for alternating current might increase and new distributing stations be required to meet the demand.

Lord Moulton pointed out that the Westminster had no statutory power to supply alternating current. If lamps of lower voltage came into general use, alternating current might become almost universal. The agreement, *inter* parties, by which the Westminster were able to supply the alternating current, was, therefore, one which might be very valuable to them.

Mr. Younger replied that while that was so, the London had got a very good bargain. At the time that the contract was made, they had only 750 consumers on the books.

The Lord Chancellor: If that statement is true, it suggests that the Westminster expected that the alternating current would come into favour, and that it would be to their advantage to enter into some arrangement by which they could supply it.

In conclusion, Mr. Younger said an injunction in the form asked for was one that the Court of Chancery could never sanction. The injunction was not to restrain the Westminster from doing a particular specific thing, but to do nothing which might be calculated to destroy, diminish, or impair the undertaking. Such an injunction would lead to endless litigation, and at any time the Westminster might be called upon to answer a motion for contempt.

Mr. Buckmaster, K.C., in reply, said that an injunction could be granted in view of the circumstances which led to this case. Two customers, at any rate, both living close to a distributing main belonging to the London company, had been refused an alternating supply by the Westminster, acting on behalf of the London company. The Westminster said they were under no obligation to supply alternating current to anyone who was not a consumer, and that if they did supply, the customer would have to take the supply from the point where it suited them best to connect his house to. An electric supply company had to keep a map showing their mains, and, naturally, a consumer would want to be connected to one near his house, because only 60 ft. of connecting wire was supplied free. If the obligation upon the London to supply was discharged by supplying, not from the nearest point, but from any point on their system, a would-be consumer might have an indefinite length of wire to pay for, although he was entitled to see the map for a fee of 1s., and on that map there was a main close to his house, and presumably he had a statutory right to be supplied from that main.

The learned counsel referred to the powers which a company was given by the Acts of 1908 and 1909 of entering into an agreement for another company to take and supply energy from the producing company. The Act of 1908 was a local Act. The Act of 1909 was a public statute.

In conclusion, he pressed their Lordships to allow the appeal.

The Lord Chancellor said the matter was one of importance, and they would take time for consideration.

Aberdeen City Electrical Engineer's Slander Action.

(*Continued from page* 370.)

Lord Hunter, in his judgment, has allowed issues for the trial of the action by jury.

In the course of his judgment, his Lordship states that it was averred that the letter was slanderous in respect, first, that it contained a false charge of professional incompetence against the pursuer; and second, that it falsely alleged that the pursuer, as city engineer, recklessly and without justification imputed dishonesty to the Aberdeen contractors. If the statements of, and concerning, the pursuer amounted to either of such charges, they would be slanderous, as to impute slander was itself a slander. For the defender, Lord Hunter continued, it was maintained that the letter narrated certain facts, and then contained an expression of opinion with reference thereto. It had, no doubt, been decided in the case of a newspaper commenting upon the actings of a public man that, as put by Lord McLaren in the case of Archer *v.* Ritchie and Co., 1891: "The expression of an opinion as to a state of facts truly set forth was not actionable, even when that opinion was couched in vituperative or contumelious language." His Lordship, however, did not think that that doctrine protected a communication written to the employer of a public official alleging that action taken by him had arisen, not from error of judgment, but from incompetence or recklessness. Besides, the pursuer did not admit the accuracy of the facts alleged by the defender in the letter complained of. His Lordship did not, of course, determine that the statements in the letter were slanderous. They appeared to him to be capable of bearing a slanderous meaning, and it was for the jury, therefore, to say whether they were used in an innocent or slanderous sense. The defender maintained that, in any event, he was privileged, as he was writing on behalf of the Association. No action lay against that body for slander in virtue of the provision of the Trades Disputes Act, but it had been decided that an official of a Trade Union might be sued. His Lordship did

not think that an official so sued enjoyed any greater privilege than the Association would have done. In the present case, the contractors, whose work was criticised by the pursuer, would have been privileged; but, so far as the averments in the present case with reference to the Association were concerned, he did not think he could hold, at all events, at this stage, that they were privileged. If at the inquiry it appeared that the Association were entitled to privilege, the jury might be directed that the pursuer was not entitled to succeed unless malice on the part of the defender were proved. His Lordship should also notice the averment made by the pursuer to the effect that the defender, in making the statements which he did, exceeded the instructions he received from the Association. If that were established, he would, or might, lose the benefit of the plea of privilege to which, otherwise, he might have been entitled.

Counsel for the pursuer, Mr. Cooper, K.C., and Mr. Lippe. Agents, Scott & Glover, W.S. Counsel for the defender, Mr. Murray, K.C., and Mr. Wilton. Agents, Davidson & Syme, W.S.

Tramcar Obstruction.

At the Bradford West Riding Court, on Thursday, a teamster, named George Rhodes, of Keighley, was summoned for obstructing a tramcar belonging to the Bradford Corporation. Mr. J. G. Gunter prosecuted, and in the evidence it was stated that the defendant had obstructed the car for a distance of some 700 yd., totally disregarding the persistent ringing of the bell on the car by the driver, and the driver had had to leave the car and lead the horse from the tramlines before the car could pass. The defendant was fined 20s. and costs.

Glasgow Car Mishaps.

In the Court of Session a settlement was intimated to Lord Dewar in the action by a Govan riveter, against the Glasgow Corporation for £1,000 damages for injuries sustained through being knocked down by a Corporation tramway car. Pursuer agreed to accept £75 and expenses.

After hearing evidence in an action by a woman whose husband had been fatally injured by a Glasgow Corporation car, a jury in the Court of Sessions awarded the widow £250, £50 to her pupil son, and £5 to each of her four other children. The Corporation denied fault, contending that the accident was entirely brought about, or materially contributed to, by deceased's own carelessness or recklessness in suddenly and unexpectedly stepping back on to the tramway track after clearing it.

Osram Lamp Works, Ltd., *v.* Schloss & Co.

On Friday, February 28th, Mr. Justice Swinfen Eady had again before him in the Chancery Division the motion in this case. This was a motion by the plaintiffs, who asked for an injunction to restrain an infringement of their lamps. It was stated on behalf of the defendants that the plaintiffs desired to answer their evidence, which had just been received by plaintiffs, and subject to his Lordship's sanction, it had been arranged that the motion should stand over for a week. This his Lordship agreed to.

County of London Electric Supply Co., Ltd. *v.* J. Salomon and Co.

In the King's Bench Division, on Tuesday, March 4th, before Mr. Justice Bankes and a common jury, an action was brought by plaintiffs against defendants, leather dealers, Rothesay Street, Weston Street, Bermondsey, to recover £1,880 for electricity supplied to the factory of the defendants at Mina Road, Old Kent Road, S.E., over a period ranging from June, 1908, to November, 1911, the claim being based upon a contention that through the misreading of the dial of the registering meter, the defendants had only been charged about one-tenth of the proper amount, viz., for 33,428 Board of Trade units instead of 334,272 at 1½d. per unit.

The defendants pleaded various defences. They said they had paid for the electricity consumed, alternatively they said it was plaintiffs' duty to supply and maintain a suitable meter, and that any loss that had occurred through mistaken reading must be borne by the plaintiffs; they also pleaded breach of statutory obligations by the plaintiffs, and entered a counterclaim against the plaintiffs, saying that they had carried on their factory upon a certain understanding as to the cost of electric power—as represented by the accounts presented by the plaintiffs and duly paid by the defendants—that they had based their estimates of cost of production on the prices charged by the plaintiffs for light, and that they would never have carried on their works if the charge had been on the scale now sued for by the plaintiffs.

For the plaintiffs, Mr. T. R. Atkin, K.C., Mr. Colefax, K.C., and Mr. Slumper appeared, and defendants were represented by Mr. Duke, K.C., and Mr. Spokes.

Mr. Atkin, K.C., said that the defendant company, it appeared, employed a certain amount of machinery in connection with their business for extracting water from hides, &c., and they took over some works at Mina Road that had been supplied with electric power, and the defendants had used the power since 1908. The defendants made a contract with the plaintiff company whereby they were to have the power at 1½d. per Board of Trade unit, the current to be registered in the ordinary way by the electric meter. The meter now concerned was in regular use, and no complaint had been made of its working. In this case the last unit in the total shown on the dial had been erroneously read as a decimal, and the result was that for 3½ years the defendants had been charged just about one-tenth of the proper charge for the current actually consumed. The mistake was undoubtedly a very unfortunate one, and it brought about the result that this leather factory had had its power for one-tenth of the correct charge as shown by the meter, the accounts submitted to the defendants being based entirely on the misreading referred to. The plaintiffs now came to Court and submitted that defendants should be called upon to pay for the power supplied to them. The mistake was discovered in 1911, and the defendants were informed, but they declined to pay and the proceedings were begun. The defendants had put in a number of different defences. They said there was a clause in the contract which barred going back more than one quarter, but this clause actually applied in the case of an incorrect meter. Here the plaintiffs contended the meter was accurate—it had only been misread. The defendants had also pleaded that the current they had had was the current they had actually been charged for, and they had acted on that basis in estimating their cost of production and the cost of carrying on their works, and they said that for three and a half years the works had been carried on at a loss, and if they had known they were using the amount for current now contended by the plaintiffs, they would have closed their works down, and therefore the plaintiffs ought to pay the defendants money in respect to the loss incurred in carrying on their works. Apparently (said Mr. Atkin, K.C.) the attitude of the defendants was like this: "If your grocer makes a mistake in his bill, and he charges you only half as much as he ought to, you can say to him, 'I will not pay your bill, because if I had known what the real bill was I should not have eaten so much jam and drank so much tea. Therefore, I will not pay for the goods that have been supplied to me.'" It was also pleaded by the defendants that the plaintiffs, in breach of their statutory powers, had supplied the current from Camberwell instead of from Southwark; but the plaintiffs would say that it was supplied to the defendants through Southwark, and that this defence could not be supported.

Counsel went on to detail the history of the electrical installation at the defendants' factory. The original company under the contract was a company carrying on business in the same premises, called the Mina Chemical and Dye Works, Ltd., and the contract was dated 1906. There was a 7½-H.P. engine, and later a 25-H.P. motor. The price was 1½d. per Board of Trade unit. It was found that defendants had had 334,272 units, and they had been charged for 33,428, so that 300,844 units had not been paid for at all. Roughly speaking, the charge for power was £600 a year, but the defendants had only been charged, in fact, £60 a year. In the autumn of 1911 a meter reader went to take his quarterly reading, and read the meter correctly. He had noticed what the figure for the previous quarter had been, and he could not understand how it could be that the consumption had jumped up ten times. He put the reading down, treating the last figure as a decimal, but he reported at headquarters the doubt he felt about the matter, and on November 7th two inspectors visited the factory and discovered the error that had been made. Certain correspondence ensued, the plaintiffs presented their account, and ultimately defendants wrote to say that they could not accept liability for irregularities in the meter; they had had the current since July, 1908, and the meter had been regularly inspected by the plaintiffs' representatives

Mr. Atkin added that as a fact it had been found that the meter showed a slight tendency to under-register intermittently, so that this was an advantage to the defendants. Counsel also said that the defendant company had entered into a new contract to have the power at 1d. per unit. Although the defendant company had in their pleadings said they would have closed their works, they had not, in fact, closed them, and counsel said he would submit that a *bona fide* mistake had been made, and the plaintiffs were entitled to recover. He would submit that the defendants could not support their defence of an estoppel. Counsel subsequently called evidence in support of his case.

Mr. Charles Sparks, M.Inst.C.E., M.I.E.E, said he was engineer-in-chief to the plaintiff company, and was responsible for the generating stations, the system of distribution, the supply and the meters. Witness spoke to the history of the electric installation at the works, and said that the meter now in question was of the type known as the "K.G.," and it was supplied by an electrical company. This type was approved by the Board of Trade in 1910, and it was supplied in 1906 to the defendants, it having not been approved at this date. He regarded this meter as the same in principle as the one approved in 1910. It was a sealed meter, and he could not see inside it to see if it was exactly the same in the details of construction as the K.G. approved type, but he believed it to be the same in principle. They had used the K.G. type for seven to eight years, and they used hundreds of them.

What's your opinion as to the suitability of the meter for registering current used at the defendants' works?—In every way it is a most suitable meter. Witness further testified that the figure that had been read as a decimal was, in fact, a unit, and should have been charged as such, and that the current was supplied through the Southwark district. Witness handed in a table, which he said was to show that the power that had been actually charged for could not be sufficient for the requirements of the defendants' machinery.

Mr. Duke, K.C., in cross-examination, suggested to the witness that the Board of Trade had never approved of a meter that carried on its face the marks that had caused the alleged misreading by the plaintiff company's servants.—Witness said they had many of the K.G. type that bore the decimal mark, but it was possibly true that never had one been approved that had a dial just like this one.

The K.G. type has only been approved for a capacity not exceeding 10 amperes?—I do not know that. Witness added that the K.G. type was made in Germany and was made for the English market.

Mr. Duke, at this point, applied to his Lordship for consent to amend the defence so as to raise the point that the plaintiffs had, in contravention of their powers, supplied power from other than the Southwark area.

Mr. Atkin, K.C., opposed the allowing of the amendment, and pointed out in the course of his argument that the defendants were still having the electricity under a new contract.

Mr. Justice Bankes said the amendment sought to raise the question as to whether the plaintiffs were acting within their powers, and he was inclined to think that he ought to explain it and assist that investigation, subject to all questions of costs being reserved.

Subsequently, evidence was called to prove that there was always a supply by the plaintiffs from Southwark, that the red-line indicated on the meter dial was used as a test, and that the K.G. type was very extensively sold on the Continent and in a smaller measure in the United Kingdom.

After the closing of the plaintiffs' case, Mr. Duke, K.C., addressed the jury for the defence. He said that the attitude the defendants took here was that they had been led to carry on their leather business for years on the footing that the cost of electricity was a certain cost, and had been paid, and that the matter must rest there, and if plaintiffs had made a mistake they must lose on their side by their error. The defendants were for a very long time in doubt as to whether it would be of advantage to them to have electric power at their works; the introduction was made on the representation of the plaintiffs that it would be cheaper than either steam power or suction gas. The defendants had gone on with their business, on the footing that the cost of the power was that which they were being charged by the plaintiffs, and the defendants now contended that plaintiffs were estopped on the ground of their own conduct. It came as a complete surprise to defendants to be told that they ought to have paid 10 times more than they had done. The defendants had, at considerable expense, laid out their works in such a way as to use electricity in the future. If this meter was one that misled every accustomed person who came to see it and misled the plaintiff company's own servants, then it was difficult to see how it could be regarded as a suitable meter. He would call evidence to show that the red line on this dial, to the ordinary understanding indicated that the figure was a decimal and not a unit.

For the defence, Mr. David Salomon gave evidence to the effect that there was nothing whatever to indicate that the meter was only registering one-tenth. Witness gave evidence at length as to his interviews with Mr. Scott before the electricity was introduced, and said he was assured that it would be cheaper than other means. He would not have used the electricity had the cost been such as now contended, and if he had known that the meter was only indicating one-tenth of the cost. Witness showed in further evidence how he had based his prices and estimates of cost of production in relation to the cost of electricity.

Cross-examined, he was still continuing his business; he had "sunk" £35,000 in it. He made a good profit last year, as the prices for leather were higher through the shortage.

Mr. Ernest Edward Sharpe, M.I.E.E., and associated with meter manufacturing for many years, deposed that he would read the last figure on the dial of this meter as a decimal, because of the red line in front. He said this mainly because of the red colour. Red was always associated with a decimal point. The German meters invariably had red to indicate the decimal point.

Other evidence of a similar character was called to show that the dial was unsuitable, that the figure on the extreme right would be read as a decimal, and that the meter was not of a type approved by the Board of Trade.

After other evidence, counsel addressed the jury, and Mr. Justice Bankes summed up. His Lordship left the following questions to the jury, and they were ultimately answered by the jury as indicated:—

Did the plaintiffs, in rendering their quarterly accounts, represent to the defendants that the quantity of electricity supplied was materially less than was actually the case?—Yes.

If so, did the plaintiffs intend in making such representation that the defendants should act upon it in determining (*a*) to continue to take a supply; (*b*) whether or not to continue to carry on their business; (*c*) the selling price of their goods; and (*d*) whether to extend their plant?—No.

Did the defendants act upon such representation to their detriment in respect to any of the above, or either of them?—They did act on it, but there is no evidence as to detriment.

Was the meter supplied a suitable one?—Yes.

Were the plaintiffs' servants negligent in reading the meter?—Yes.

Did the plaintiffs keep the meter in proper order for correctly measuring the supply?—Yes.

Ought the defendants by the exercise of reasonable care to have discovered that they were consuming more electricity than they were paying for?—Yes.

The case was ordered to be set down at a future date for legal arguments to be heard on the jury's answers.

Woollen *v.* London United Tramways, Ltd.

In the Divisional Court of King's Bench, on March 4th, Mr. Justice Channel and Mr. Justice Bray heard an appeal from a judgment of Judge Woodfall given in the Westminster County Court in this action. The plaintiff, at about 4 o'clock in the morning, was driving from Ealing to London in his motor-car a party of ladies who had been to a dance, and he came into collision with a rail scrubber which was at work on the tramline. The evidence at the trial was very conflicting as to upon whom the blame rested, and the County Court Judge found for the plaintiff.

Mr. Hayden, who appeared for the respondent (the plaintiff in the action), contended that the Court had no jurisdiction to hear the appeal, as the defendants raised no point of law at the trial. Their Lordships, however, decided that the case would have to be heard before they decided whether a point of law could have been raised.

Mr. Rayner Goddard, for the appellant, stated the facts of the case, and said that although the plaintiff had been found to have been guilty of contributory negligence, the Judge had decided in his favour, on the ground that the driver of the "scrubber" had also been negligent in not sounding his gong. If he had sounded his gong, said the County Court Judge, the plaintiff would not have been entitled to recover. There was no evidence that the defendants' servant was responsible for the accident, and upon the facts found by the County Court Judge, he (counsel) asked for judgment for the defendant company, or a new trial.

Mr. Justice Channel said that, without saying whether the result of the trial was right or wrong, he was of opinion that the case had been decided upon a question of fact, and not of law. The fact of the trial having been unsatisfactory was no ground for a new trial, and the appeal would, therefore, be dismissed.

Mr. Justice Bray concurred, and the appeal was dismissed with costs.

BUSINESS NOTES.

Lamp Tests.—The Westminster Electrical Testing Laboratory has just completed a series of life tests on 13 of the best-known makes of metal-filament lamps. These tests indicate the relative values of the different makes now on the market, and show, when compared with the previous tests, the progress that has taken place during the last 12 months. Five 200-volt 32-watt lamps were ordered of each maker, and were run for 2,000 hours on an automatically regulated 200-volt circuit. The candle-power and consumption of each lamp were measured at the start and afterwards every 250 hours. The report contains all individual results, as well as various tables of averages. The tests show very clearly the need for including in a specification a specified life as well as specified limits of efficiency, which should be, in many cases, quite outside the makers' regular standard.

For Sale.—The Dewsbury Corporation has for disposal a quantity of steam-driven generating plant. See our advertisement pages in this issue.

Air Filters.—Mr. H. R. Witting, 41, Berners Street, London, W., the sole British representative of Messrs. K. & Th. Möller, G.m.b.H. of Westphalia, informs us that he has recently booked orders for patent single pocket air filters from the following:—James Simpson & Co., Ltd.; Wellman, Seaver and Head, Ltd.; C. A. Parsons & Co., Ltd.; W. Beardmore & Co., Ltd.; the Brush Electrical Engineering Co., Ltd.; the Glengarnock Iron and Steel Co., Ltd.; Dick, Kerr & Co., Ltd.; the British Westinghouse Electric Co.; the Newcastle-on-Tyne Corporation Tramways, and others.

"Lux" Electric Candles.—The Lux Candle Co., Ltd., of 36, Whitfield Street, Tottenham Court Road, London, W., announce improvements in these candles in a leaflet just issued. A different make of metal-filament lamp of improved efficiency and strong filament is now employed, which is made for up to 125 volts, without increasing the size of the bulb at the candle point or spoiling the candle-like appearance.

Book Notices.—"The C.D., 1913." Melbourne: Critchley Parker. This is the Australian Mining Standard Classified Directory of makers of mining, electrical, and industrial machinery and other manufactures for the mine.

"The Newspaper," by G. B. Dibblee. Home University Library, No. 69. London: Williams & Norgate. 1913. Price 1s. net.

Catalogues and Lists.—Messrs. Gilbert Gilkes and Co., Ltd., Kendal.—New catalogue of 16 pages, containing a full description, with line drawings and half-tone illustrations, of their "Cen-turi" centrifugal pumps, which embody entire revision of designs and patterns. Tabular information is detailed respecting single-cell and multi-cell pumps, and other useful matter, is given, including notes on installation and working. A loose sheet tabulates prices of the pumps.

Adnil Electric Co., Ltd., Artillery Lane, London, E.C.—Effective newspaper folder, issued with the object of showing how their indirect lighting fittings eliminate possibility of "glare."

Mr. H. C. Slingsby, 142-146, Old Street, London, E.C.—Eight-page list (No. 142), effectively illustrating their extension ladders.

The Westinghouse Cooper-Hewitt Co., Ltd., 80, York Road, King's Cross, London, N.—List No. 40 relating to the special adaptability of Cooper-Hewitt lamps to the production of cinematograph films. The leaflet sets forth the prices and general advantages, one of which, apart from the high actinic value of the light, is the economy in current consumption.

Messrs. Ozonair, Ltd., 96, Victoria Street, London, S.W.—New pamphlet No. 3 (32 pages), containing a description of the Ozonair system of pure air ventilation. Introductory notes deal with the principles of ideal ventilation. The apparatus is finely illustrated, and there are also many pictures of buildings, &c., where the system is in use.

The Emanda Engineering Co., Ltd., Emanda Works, Sumner Avenue, Peckham, S.E.—Sheet of illustrations showing their switch and fuseboards, distribution boards, &c.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Abridged illustrated price list of round pattern switchboard instruments, electromagnetic and moving coil.

Messrs. J. H. Holmes & Co., 17, Soho Square, London, W.—New pamphlet of 48 pages (newspaper printing section) containing a description, with illustrations, of their improved Holmes-Clatworthy system, with hand or push button control for electrically operating rotary web presses. A number of improvements have been introduced.

Messrs. Fredk. Braby & Co., Ltd., Ida Works, Deptford, London, S.E.—In a small pocket pamphlet of eight pages the firm give information respecting economical storage of petrol, and the underground storage tanks, pumps and overhead measuring tanks and other apparatus supplied by them for that purpose.

Messrs. Meldrums, Ltd., Timperley, near Manchester.—Several new publications describing respectively the Meldrum improved forced-draught furnace; patent refuse destructors; and the "Koker" and "Sprinkler" mechanical stokers.

Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool.—Admirably got-up pamphlet of 36 pages, containing a full account (with numerous clear sectional diagrams and beautifully-executed photographic reproductions of completed plants) of the combined impulse and reaction turbine built by the firm. This is of the same type as that built by Messrs. Brown, Boveri & Co., of Baden, and Messrs. Richardsons, Westgarth have supplied, and have in hand, a large number of machines of this type of various sizes. In addition to general and constructional particulars, there are test curves given. Turbines for special purposes (back-pressure and bye-pass) are also included.

The Power Plant Co., Ltd., West Drayton, Middlesex.—Four-page leaflet, giving a specification of their self-contained mill gears for low and medium ratios.

The Stearn Electric Lamp Co., Ltd., 47, Victoria Street, London, S.W.—Illustrated and priced leaflets respecting the new Stearn "Globolite" lamp, heating and the "Leuconium" lamps.

Strike Settlement.—We are informed that the strike at the works of Messrs. Eversheds & Vignoles, Ltd., caused by the dismissal of a workman for reading instead of going on with his work, has been settled by the withdrawal by the men of the demand for his reinstatement. The company on its part has undertaken to take back the strikers into its employ. It is stated that with one or two exceptions, good feeling has prevailed during the struggle, which involved the whole of the workshop hands, numbering about 220. The support of the staff and a number of other employés has helped materially in bringing about the successful issue of the dispute. The firm ask us to state that the aid received from a large number of manufacturers has strengthened their hands in the conduct of the matter, and to these manufacturers they express their thanks for such assistance. Messrs. Evershed & Vignoles ask customers to continue to extend to them consideration in the matter of deliveries, as these will necessarily for the present be somewhat delayed, though no effort will be spared to speedily remedy this.

Trade Announcements.—With reference to a notice that appeared in our last issue, Messrs. Ward & Goldstone state that in place of Mr. Stafford Sinclair they have engaged Mr. G. G. Turvey to act as their Glasgow representative. They are giving up their present address at 50, Wellington Street, Glasgow, having taken more commodious premises in West Campbell Street, which will enable a larger stock of their manufactures to be kept, and will also afford greater facilities for showrooms, &c.

Mr. Leo. Eppenheim has taken into partnership Mr. Percy Levy, and the business will be carried on under the style of Leo. Eppenheim, Levy & Co., at 31-5, Duke Street, St Mary Axe, E.C.

Messrs. Jones & Attwood, Ltd., heating and hydraulic engineers, of Stourbridge, have added an electrical department for the supply and erection of plant and fittings for all kinds of electrical work, with Mr. W. Bannister as manager.

Premises at 60, Hamilton Square, Birkenhead, have been taken by the Economic Electric Co., electrical and mechanical engineers.

Mr. H. W. Power, engineering publicity expert, of 31, Queen Victoria Street, E.C., informs us that his telephone number is now City 8590, instead of 8509, as given in the Universal Electrical Directory.

Mr. F. H. Way has been appointed Midlands' representative for the Electrical Apparatus Co., Ltd., with headquarters in Birmingham, and Mr. W. Roberts (late of the British Westinghouse Co.), has been appointed the firm's South Wales representative, with headquarters in Cardiff.

During the past year, large extensions and improvements have been made in the works of the Hoffmann Manufacturing Co., Ltd., at Chelmsford, which are devoted entirely to the manufacture of ball and roller bearings and steel balls. Extensions to the grinding department, cage department, testing department, and stores have been made, increasing the available floor space by 28,200 sq. ft. Even with the above extensions, the demand has again overtaken the capacity of the plant, and, at the present time, additional extensions are being made. A further Diesel engine of 1,000 H.P. is on order, making the total available horse power over 2,000.

Messrs. W. White & Co., have taken larger premises at 25, Budge Row, Cannon Street, London, E.C., the premises recently occupied by Messrs. Krupka & Jacoby.

Bankruptcy Proceedings.—Charles Spencer Northcote, electrical engineer, 67, Stanthorpe Road, Streatham, London.—The public examination of the above named debtor was held at the Court House, Wandsworth, last week, before Mr. Registrar Willoughby. The statement of affairs showed liabilities amounting to £1,713 and assets estimated to produce £61. Questioned by the Official Receiver, debtor stated that in 1906 he left a company with which he had been connected, selling his shares for £4,000, and starting on his own account at Queen Anne's Gate, Westminster, under the style of "Wholesale Electric Traders." In 1908 he was concerned with an electrical exhibition, over which he lost £2,000. He gave up his office three years ago, and since then had been living on his capital, having no paying business. His capital became exhausted at the beginning of last year, and he gave instructions to Messrs. Debenham, Storr & Sons, auctioneers, to sell the greater part of his furniture. Debtor was dissatisfied with the amount handed to him, and as a result of statements made in letters sent by his solicitors to Messrs. Debenham, they commenced an action for libel. Judgment was given against him, and subsequently the damages were assessed at £400. Debtor calculated that he had lost £1,000 over the sale of a house at Forest Hill. The examination was adjourned.

W. H. Mickleth wait, electrician, Harrogate.—First meeting, March 13th; public examination, April 4th; both at York.

Liquidation.—Rossendale Belting Co., Ltd.,—A petition (presented by Messrs. A. E Bennett & Co., Liverpool) for winding-up this company, is to be heard on March 17th at Liverpool.

LIGHTING and POWER NOTES.

Accrington.—Negotiations respecting the supply of electrical energy to the paper works of Messrs. Peebles & Sons have been in progress, and application is to be made to the L.G.B. for power to borrow the amount required to carry out the requisite extension.

A report in regard to the new gas engine plant has been issued by the electrical engineer. A three months' trial on one engine and electrical generator started on February 4th, running 164 hours per week, as near to full load as circumstances permitted. The gas making plant started a three months' trial on March 1st.

Barking.—It has been decided to withdraw the Council's opposition to the Romford and District Electric Lighting Order, conditionally upon the words "by agreement, but not otherwise" being inserted after the word "may" in line 10 of Clause 20 (Bulk Supply) of the Order. At the last meeting of the Council a report from the clerk was considered, showing the position of affairs with regard to (1) the suggested transfer of the electric lighting undertaking; (2) the taking of a bulk supply of energy from the West Ham Corporation; (3) the taking of a supply of electricity for traction purposes from the East Ham Corporation; and (4) the proposed leasing of the light railways from East Ham boundary to Loxford Bridge, to the East Ham Corporation. It was decided (*a*) to take no further regard to item (1) at the moment; (*b*) that the consideration of item (2) remain in abeyance; (*c*) that the clerk negotiate further with the East Ham Corporation with regard to item (3); (*d*) that with regard to item (4), the East Ham Corporation be informed that the terms suggested are such as cannot be accepted; (*e*) that the engineer prepare a report upon the question of extensions to the electricity plant, to which item (2) be also referred.

Barrow-in-Furness.—The T.C. has approved of the Electricity Committee extending the mains on Walney Island in order to supply current to 102 houses which are to be erected by Messrs. Rainey Bros. The electrical engineer reported that at the next meeting of his committee he hoped to put forward some definite proposition in regard to fixing electric cooking apparatus in each of the houses. It was agreed to support a demonstration of the uses of electricity by the British Electric Transformer Co., Ltd.

Beckenham.—The U.D.C. has applied to the L.G.B. for sanction to borrow £2,500 for services and £1,000 for meters in connection with its electricity undertaking.

Birmingham.—The proposed new power station scheme at Nechells, to provide an additional 100,000 KW. of generating plant, is still held up. The committee's indecision is explained by the nearness of the end of the financial year, the trading result of which should be available shortly.

Bispham (near Blackpool).—An inquiry has been held by Mr. T. C. Ekin, L.G.B. Inspector, relative to the Council's application for sanction to borrow £8,178, for extensions to the electricity undertaking. Although the station has only been in

operation a little over 12 months, the demand for electric lighting has far exceeded the anticipations of the Council, which has found it necessary to increase the plant to something like two and a half times its present capacity. There was no opposition to the application.

Bolton.—The Electricity Committee has approved of the plans of the proposed generating station, completed with the amendments decided upon by the engineers.

The chairman and vice-chairman have been deputed to open and tabulate the tenders for the supply of switchgear.

Continental Notes.—Luxemburg.—It is reported from Luxemburg that, after protracted negotiations, an agreement has been reached between the Government of the Grand Duchy and an English power association, whereby the latter undertakes shortly to begin the erection of the proposed Sauer Valley dam in the upper Oesling, in connection with the hydro-electric scheme for the supply of the whole of the Duchy. The expenditure on the work is estimated at £640,000, and the approval of the agreement by the Chamber appears to be assured. Associated with the scheme is a rumour of the projected establishment of a large new steel works near Erprldingen, above Ettelbruck, which would obtain its supply of power from the hydro-electric works in question.

France.—A company has just been formed at Aulne (Parthe), with a capital of £10,000 and the title La Société Sarthoise d'Electricité et de Force, to establish a small electricity generating station in the town.

Sweden.—The Stora-Kopparbergs Aktiebolag, the second largest mining company in Sweden, and the owner of a large area of timberland, is going to erect a large electrical power station at Forshufoud, to utilise the falls of the Wal River. The same company may be said to be the financial pioneer of the development of electrical smelting of iron-ore in Sweden and elsewhere, and has, in addition to the electrical furnace at the Domnarhufoud Iron Works, another electrical furnace of different construction in operation, the latter having a capacity of 12,000 H.P.

Norway.—The largest power station in Europe, says the *Génie Civil*, is being constructed on the Norefall, near Nore, in the Numedal, to supply electricity to Christiania and Eastern Norway. The buildings, 160 m. in length, are at the foot of a mountain, upon which will be a penstock fed from a reservoir 6 km. away, and the available head will be 420 m. There will be 11 turbines of 20,000 H.P. each and two of 10,000 H.P., making a total of 216,000 H.P.

Dartford.—The U.D.C. has applied to the B. of T. for consent to supply current in the rural area to the premises of Vickers, Ltd., the S.E. and C. Railway Co., at Slades Green, Messrs. Richard & Brignall, Messrs. Murgatroyd Bros., Messrs. G. P. and J. Baker, and Messrs. D. and C. Rutter, Ltd., all in the parish of Crayford. It is proposed to give the supply by means of overhead cables, carried as far as possible alongside the railway.

The Electric Lighting Committee has had under consideration the question of the scale of charges for current. It states that the falling off in the demand for power purposes is adversely influencing the finances of the undertaking, and recommends a fixed charge of 25s. per KW. (approximately £1 per H.P.) of demand per quarter, and in addition charges based on consumption varying from 1½d. to 3d. per KW.-hour. The Committee states that Messrs. Vickers, Ltd., who have already arranged to take current at their Crayford Works, will be requiring before long 200 KW. The capital expenditure is put at £4,300, of which £1,800 would be spent on two 250-KW. rotaries, with transformers to raise pressure to 6,600 volts, and £600 on two 200-KW. transformers at Vickers' premises, and the necessary switchgear. The total demand would run to some 450 KW., and the capital expenditure be raised to £11,000, with annual receipts on the new scale of £4,705, as against an expenditure on coal, wages, interest and repairs of £3,375.

Dorset. — The County of Dorset Electric Supply Co. has been successfully floated, and is putting in hand the scheme for supplying electricity to the various towns in Dorsetshire, particulars regarding which have already appeared in these columns. The works in Swanage, Dorchester, and Blandford are being started this spring, and it is hoped that the supply will be available in the course of a few months. It is intended to start the works in the other towns in Dorset—Sherborne, Wimbourne, &c., directly circumstances permit.

Dundee.—The Dock Street sub-station is now completed and capable of relieving Dudhope Crescent Road Station of 1,500 KW.

Specifications have been issued for the steelwork and chimney for the extensions at Carolina Port. Tenders are due on the 10th inst.

Edinburgh.—The T.C. has agreed to raise the maximum salary of the station engineer at McDonald Road station from £270 to £330 per annum, by such increments as may be recommended by the resident engineer with the approval of the Committee. The convener of the Committee justified the increase on the ground that the salary of £270 was fixed 10 years ago.

Faringdon.—Works for electric lighting for this town have been constructed at the old brewery in Southampton Street. Consent of the public authorities to the erection of the poles having been given, most of the poles are now in place, but a numerously signed protest against these erections has been sent to the District Council, complaining of their unsightliness. The Council, however, has refused to move in the matter.

Fleetwood.—A L.G.B. inquiry was held on February 25th into the application of the D.C. to borrow £7,176 for the purpose of the electricity undertaking.

Galashiels.—The Tenants' Association has unanimously petitioned the T.C. to make the supply of electricity a Corporation concern. The question engaging public attention at present is whether the scheme should be undertaken by the Council or by a private company. Before coming to a decision the Council sent a deputation to Glasgow to consult an expert, and the members reported to a private meeting the result of their visit. On Thursday, last week, Mr. Parsons, the expert consulted, visited Galashiels for the purpose of getting information to enable him to prepare his report.

Halifax.—It is proposed to extend the H.T. supply to the works of Messrs. Asquith, Ltd., at a cost of £352 (subject to a guarantee that the income will not be less than £200 per annum for five years), to West Croft Mills, and to New Brunswick Mills, at an estimated cost of £398, and to Horley Green Mill, at an estimated cost of £767.

Haslingden.—The L.G.B. has sanctioned the loan of £3,750 for a period of 25 years for electricity cables, and the sum of £1,500 for a period of 15 years, for electric services.

Hastings.—A L.G.B. inquiry has been held concerning the application of the Corporation to borrow £8,133 for electric lighting. In one item of £4,000, the engineer (Mr. Ferguson) said he might include the cost of a high-tension main to the borough boundary, The Inspector said the amount was not ear-marked, and it would be left to the Council to act as it pleased. At the close of the inquiry, there being no opposition, the Inspector said the improved position of the undertaking was quite encouraging. There was rather a long list of what they might call "moral obligations" when they got to the right side. He noticed that the number of consumers had gone considerably. "Don't spend your money on buildings; spend it on wheels," added the Inspector.

Hebden Bridge.—The D.C. has decided to apply to the L.G.B. for sanction to borrow £3,250 for the purpose of extensions at the electricity works.

It is anticipated that, for the first time since the electricity works were started, there will be a profit on the working of the undertaking.

Heston and Isleworth.—The electrical engineer, Mr. P. Rycroft, reported to the last meeting of the U.D.C. that the engine for the new plant would not be ready until the middle of March owing to the difficulty that had been experienced by the makers in obtaining castings and fittings.

Keighley.—The Electricity Committee has made a recommendation that an agreement be entered into with the Bingley U.D.C. for the supply to the latter of electrical energy, in bulk, on the three-phase extra-high-tension system at 6,600 volts, 50 periods per second, on the following terms:—The U.D.C. to pay a fixed annual charge according to the following scale.—If the consumption does not exceed 300,000 units per annum, £400; if the consumption exceeds 300,000, but is not more than 400,000 units per annum, £500; if the consumption exceeds 400,000 units per annum, £600. And in addition to such fixed charge, ⅝d. per KW.-hour registered by a meter to be fixed at the Bingley end of the H.T. cable; accounts to be subject to 5 per cent. discount, and to be paid quarterly. The agreement to be for a definite term of 10 years, with options to the Bingley Council to extend the term for two further periods of five years each. Application will be made to the B. of T. for an order to give effect to the proposed agreement.

Plymouth.—The T.C. is making application to the L.G.B. to borrow the sum of £5,500 for the purpose of extending the plant at the electricity works. The Electricity Committee reports that it is estimated that the sum required for interest and sinking fund will amount to £488 per annum, and that the saving in working expenses that will result from the operation of the proposed plant will equal the above capital charges at the time it is put into operation. The increase in total plant capacity will enable additional and profitable revenue to be earned. Cables are to be laid to Laira, subject to the intending consumers entering into an agreement.

Portishead.—At a meeting of the Council the Lighting Committee recommended (the matter arising out of the agreement between the Council and the new Electric Lighting Co.) that, as the streets and highways were to be illuminated by electricity, the number of lamps should be increased by 61, making a total of 174, with the 113 existing lamps. The cost of the 113 gas lamps was £285, and the increase of more than 50 per cent. in the number of electric lamps would mean an additional expenditure of only £39. The report was unanimously adopted.

Radstock (Somerset).—At the last meeting of the U.D.C., a special committee appointed by the Council presented an extensive report upon the question of the public lighting of the town. The gas projects having practically failed, the Committee stated it turned its attention to the question of electric lighting, and secured the services of a well-qualified engineer from London, who visited Radstock and forwarded the surveyor a lengthy report.

With regard to public lighting, the scheme provides for 150 lamps of 50 and 100 C.P., lighted for 1,500 hours per annum. It was proposed that a charge of 6d. per unit be made for private lighting. The capital expenditure was estimated as follows:—Buildings and foundations, £200; plant, including moving the engines, new dynamos, battery, switchboard, &c., £1,130; motors for sewage pumps, £135; street lighting, £285; overhead mains on wooden poles, £1,700; services and meters, £150; cost of prov. order, £200; legal and other expenses, £200; total, £4,000. The revenue was estimated as follows:—Public lighting, 150 lamps, £210; private lighting, 1,600 25-C.P. lamps with current at 6d. per unit, £480; power, £25; sewage pumping, £25; meter rents and sundry receipts, £25; total estimated gross revenue, £765. The corresponding expenditure will total £575. With reference to the total amount which would probably be required to extend the undertaking, if Radstock only were served, it was considered a further £1,500 might be required for additional plant and mains in two years after the undertaking has been started; if Peasedown were included another £2,000 would probably be required. After some discussion, the matter was deferred until the May meeting of the Council.

Reading.—The Electric Supply Co., Ltd., has applied to the T.C. for consent to the alteration of the frequency of the supply of current in certain parts of the borough where the supply is given by alternating current, to 50 periods per second.

Shipley.—The U.D.C. last week decided to carry out extensions to the electricity works, at a cost estimated at £14,000. The electrical engineer (Mr. Redman) reported that at present the load was just equal to the full safe capacity of the plant, and that it would be overloaded next winter. If the Council were to undertake the supply of power to manufacturers, it would be absolutely necessary to install new plant. This would entail the purchase of an additional turbo-alternator, boiler, motor-generator, condenser, and a new building and switchboard, with which outlay the Council would be provided with a modern 1,000-KW. set.

Slough.—By installing electricity at the workhouse, the Guardians for that town have effected an enormous saving. For the year just ended, the actual cost for current was £47, against £200 for gas in the previous year. Taken altogether, it is estimated that a saving of £300 a year has followed the introduction of electricity for lighting, pumping, and laundry purposes.

Southampton.—Additional plant is required to meet next winter's load, and, upon sanction being received from the L.G.B. to the proposal, tenders are to be invited. The estimated cost is put at £8,200.

Stalybridge.—At a meeting of the Joint Tramways and Electricity Board on February 27th, it was reported that the Extensions Sub-Committee had recommended a boiler house extension plan for acceptance, and had expressed the view that it would be unwise to further extend on the present site. Mr. Noel (chairman of the Generating Station Committee) said the extensions were now going on. They had written to the L.G.B. pointing out that they were so handicapped that they were obliged to go on with the work. The demand for electricity continued to increase.

Tottenham.—The North Metropolitan Electric Power Co. having been invited by the Council to submit terms for lighting the parish, has replied that it is not prepared to carry out the whole of the street lighting, but only in those streets where its mains are laid. The Tottenham and Edmonton Gas Co. sent a letter to the same meeting of the Council, stating that it would have no possible objection to competition with the Electric Power Co. so long as it was for the whole of the district, and not for the best selected parts; also, conditionally that actual candle-power is taken into consideration as the basis for comparison. The company proceeded to quote prices. Both letters were referred to a Committee.

Tutbury (Staffs.)—The R.D.C. has given its consent to the erection of an overhead H.T. main from the borough boundary to the pumping station at Stretton, in order to supply electricity to the Clay Mills pumping station and the works of the English Grains Co., Ltd.

Walthamstow.—An additional feeder is to be laid to the corner of Church Hill and Hoe Street, at an estimated cost of £828; and a second cooling tower is to be installed at the electricity works. The cost of this latter work is put at £1,800. Current is to be supplied to the factory recently opened in Billet Lane by the Fuller Electrical Engineering Co., at an approximate cost of £1,128. In view of certain observations by the district auditor, the consumption of current at the various Council schools is, in future, to be grouped together for the purpose of fixing the charge to be made.

Warrington.—The electrical engineer has been directed to report upon the capacity of the plant and the supply of power in anticipation of the demand during next winter; also to purchase 25 domestic electric irons, and sell or hire them out. Tenders are invited for an annual supply of motors.

Whitstable.—A memorial with the signatures of 266 residents at Tankerton has been presented to the U.D.C. urging that body to favourably consider the electricity scheme submitted by a private company, as "in our opinion this should prove a most attractive addition to our town, and besides bringing about healthy competition with the existing lighting supply, will no doubt bring more residents to this district, as there will be the inducement of a cheaper light for domestic use."

Worksop.—The T.C. has arranged to give a temporary supply of current to the works of Messrs. Oates, Ltd., and arrangements are to be made for a permanent supply for a fixed number of years.

Wrexham.—Having established a rate of ½d. per unit for shopkeepers, thus enabling them to adopt heating at a competitive price, Mr. Pickvance, the borough electrical engineer, recently suggested a modification of the present assessment tariff to the extent of giving householders an alternative to the present charge. The new rate is 15 per cent. on the net assessment of the house, and ½d. per unit for all current used. Taking an ordinary assessment and ordinary consumption for lighting, 15 per cent. and ½d. per unit for the current is, he states, very little different in its net result to the existing charge, which is 12½ per cent. and a certain number of free units, with 1d. per unit for current used in excess. The advantage, however, of 15 per cent. and ½d. per unit is that cooking and heating may be adopted without any fear whatever as to large bills, and as the department is securing a fixed sum per annum which pays all standing charges comfortably, the scale will be a very beneficial one to the undertaking. The engineer's recommendation was unanimously adopted by the Council.

The borough electrical engineer submitted, at the meeting of the T.C. on February 25th, a letter from the secretary of the Wrexham Co-Partnership Tenants, Ltd., inquiring whether the Corporation would be prepared to supply electricity to the houses and other property proposed to be erected on land between Gresford and Wrexham, where they intended to place a "garden city" close to the new Gresford Colliery. The Council instructed the engineer to present a detailed report.

TRAMWAY and RAILWAY NOTES.

Accrington.—The Electricity Committee recommends that a sum of £1,568, equal to a rate of 2d. in the £, be appropriated from the tramways to rate funds for the year 1913-14.

Bacup.—The capital cost of the Bacup Light Railway (tramway between Bacup and Rochdale) has been agreed with the Rochdale Corporation as follows:—Cost of the order and agreement, £462; permanent way, £12,123; overhead equipment, £2,611; cars, £4,950; car-shed, £1,118; land, £76; total, £21,342. It was resolved that the Rochdale Corporation be approached with a view to ascertaining whether it would be prepared to work an extension of the Bacup Light Railway along Burnley Road.

Bradford.—A scheme is in progress of negotiation for the establishment of a through tramway service between Bradford and Dewsbury, by way of Batley and Birstall. The only through service between Bradford and any other town running tramways is at present that to Leeds, and, as in that case, the gauge of the Bradford lines differs from that of the lines of the Heavy Woollen District Tramways Co.'s lines, with which the junction will have to be made in the service to Dewsbury. It is proposed to use special cars fitted with the patent extensible axle invented by Mr. C. J. Spencer, manager of the Bradford City Tramways, and which is in use on the Leeds-Bradford system. The establishment of a through service with Dewsbury would reduce the journey between the two places from 50 minutes to 35.

The long-deferred linking-up of the Bradford and Brighouse tramways by way of Wyke and Bailiffe Bridge is expected to come to fruition within the next few weeks, when a stretch of 7½ miles of hilly road will be traversed. This will be the third point at which the Bradford tramways will meet those of Halifax, the others being at Shelf and Queensbury. The new line will, it is expected, bring down the exorbitant railway charges of the locality.

Burnley.—The Tramways Committee has decided to gradually remove all the centre pillars, which carry the trolley wires. It has been recognised that, in view of the constantly growing fast vehicular traffic, these poles are a source of danger.

Continental Notes.—GERMANY.—By a majority of a single vote, a Special Committee of the Prussian Diet has decided to allocate £1,250,000 towards the electrification of Berlin's city railway and circular system. The proposal to proceed at the same time with the electrification of the suburban lines was defeated by a large majority.

Croydon.—At the B.C. meeting on Monday, 20 new fare stages were adopted, of which 13 were 1½d. distances. The chairman of the Committee (Councillor Denning) explained that this was not a cutting of fares, the new stages being uniform with the existing ones. A resolution for the adoption of ½d. fares was lost by a substantial majority.

Dublin.—At the half-yearly meeting of the Dublin and Blessington Steam Tramway Co., the chairman stated his conviction that the electrification of the line would immediately turn it into a paying concern.

Glasgow.—This week the Tramways Committee formally took over the new 5,000-KW. turbo-alternator which has been installed in the Pinkston power station by Messrs. Richardsons, Westgarth. The Corporation installed a turbine of 3,000 KW. at Pinkston, and it, together with the original engines, has hitherto carried the whole load. The two turbines will now do the work, the original engines being only used in cases of emergency. The

change has been brought about partly owing to the increased demands for tramway power, but it will also add to the efficiency of the station, and will effect a saving in the consumption of coal estimated to amount to between £2,500 and £3,000 per annum. The new turbine and generator have cost £10,200, bringing up the cost of the two turbines and the electrical apparatus to £20,400, compared with £102,000, which was the cost of the original plant.

The officials of the T.C. Tramways Department are looking forward with hopeful expectation to topping the million pounds sterling in revenue for this financial year, which ends on May 31st. Confidence is lent the outlook as the result of the last quarter's trading, which ended on February 28th; the number of passengers carried from June 1st to March 1st shows an increase of no less than 28,442,688 over the corresponding total of last year, the figures being: 1911-12, 200,859,408; and 1912-13, 229,302,096. This large augmentation is largely due to the doubling of the ½d. stages early in the course of the present financial year—a course which was expected to bring down considerably the aggregate earnings. That this anticipation was not justified is apparent from the revenue to date, although it was not until about Christmas week that a deficiency was overcome and finances began to mount. The earnings on cars to February 28th for the nine months totalled £743,744 17s. 8d., against £738,558 8s. in the corresponding period a year ago, an increase of over £5,000. As the weekly drawings now average over £19,000, the million of income is, as stated, looked upon as sure, there being still 13 weeks to go.

As reported recently in the REVIEW, Glasgow T.C. is exercised over the question of providing better facilities of access between the north and the south banks of the Clyde, and the Tramways Department of the Corporation, recognising that the cars contribute to the congestion in the main traffic arteries, have verbally offered to share in the cost of erection of a new and suitable bridge. The matter was remitted to the various Committees whose interests were involved, and this week the Tramways Committee appointed members to represent it in negotiations.

Huddersfield.—Great keenness is shown by the townships of Elland and Greetland for the carrying out by the Corporation of the proposed electric tramway along Long Wall. The Huddersfield authorities, however, appear to be having some difficulty with the County Council, which has submitted long clauses to Huddersfield, including one for the widening of the way known as Long Wall, an undertaking which would cost £3,000, quite apart from certain points of land ownership which might arise. The Greetland Council has written urging the county authorities to be as lenient as possible, and it appears likely that Greetland and Elland will combine in support of Huddersfield.

India.—In connection with the electrification schemes which the Indian railway authorities are understood to have placed before Mr. C. H. Merz, the following projects have been under consideration:—

1. The electrification of the Bombay suburban lines of the Great Indian Peninsula and Bombay, Baroda and Central India Railways. The network here involved is anything from 50 to 100 miles of track.
2. The electrification of the Calcutta suburban lines of the Eastern Bengal State Railway; the conversion of from 20 to 40 miles of track is contemplated in the first instance.
3. The conversion of the Ghatz (main line) section of the Great Indian Peninsula Railway, involving some 30 miles of track. This scheme would be of special engineering interest, as the nature of the Ghatz inclines has always provided locomotive and traffic working problems of great difficulty.
4. The electrification of the Karachi Port Trust Railways.
5. Mr. Merz was also consulted by the authorities of the Ceylon Government Railways, but no details are so far available in this matter. It may, however, be pointed out in this connection that by means of a big engineering scheme, involving extensive bridgework, the railways of Ceylon are now being linked up with those of India, so that a decision to electrify the lines in the south of the mainland would not be without a bearing on the future of the Sinhalese Railways.

Lancaster.—In proposing at the T.C. the adoption of the minutes of the Tramways Committee, Mr. J. Wilkinson referred to the gratifying increase in the traffic returns, and stated that, if they had more top-decked cars, the Committee believed the increase would be still greater.

Leeds.—The City Council at its meeting on Wednesday was asked to approve a resolution of the Tramways and Electricity Committee to adopt a plan for buildings for a tramway depôt and offices, and a club for the men, upon land in Sovereign Street, at an estimated cost of £22,000.

Leyton.—The purchase of an electric watering van is under the consideration of the Council. The cost of the vehicle, with a 1,800-gallon capacity, is put at £770.

Liverpool.—Sanction has been received from the B. of T. to the borrowing of £8,000 for the provision of additional tramway cars.

Llandudno.—The receipts of the Great Orme tramways for the half-year amounted to £1,747—the highest on record; the net profit was £983, and the number of passengers carried was 61 829.

Newcastle-on-Tyne.—A collision of a rather serious character—over 30 passengers being more or less injured—occurred on the North-Eastern Co.'s electrical lines at Manors Station on Saturday morning. The accident was due to a following steam train, and of no account electrically, except as regards the reported short-circuiting of the live rail, which apparently did not lead to fire. A second accident occurred later about a mile away, when an electric train jumped the points without apparent damage to itself, and blocked three tracks for some time.

Quinton.—The Light Railway Commissioners on February 26th held an inquiry into the application of the Birmingham T.C. for powers to construct a light railway at Quinton, which will unite the systems between the city boundary and Halesowen. There was no opposition.

Salford.—Ten combination tramcars are to be dismantled, and tenders invited for the supply of car bodies and trucks, to be fitted with the electrical equipment taken from the combination cars. Application is to be made to the L.G.B. for sanction to borrow £700 to cover the cost of the installation of filtration plant at the electricity station.

South Africa.—Although a somewhat belated move has now been made to carry out the ratepayers' mandate in regard to the railless traction scheme for Bloemfontein, some considerable time must necessarily elapse still before the city possesses a fully equipped system. It is, of course, impossible to specify a given time in which the system will be completed, but it is hoped that the work will be practically completed at the expiration of a period of six months from the time when operations are commenced in earnest. To facilitate the work, much depends, of course, on the condition of the city's thoroughfares through which the tramways will pass. At present the majority of the streets are in a deplorable condition, and it is urged that matters could be facilitated very considerably by this question being taken in hand at once, and a substantial vote being given now towards a thorough and much-needed overhauling of the city's streets.

South Shields.—Mr. W. T. Robson, the manager of the Corporation tramways, has submitted a report to the Committee recommending that a 1d. fare be adopted generally on the system. It is pointed out that in the receipts for 1912 1d. fares represented 84·68 per cent. of the whole total, and 1½d. fares 4·08 per cent., the balance being made up of children's, workmen's and return tickets. As the percentage of 1½d. fares was so low, and taking into consideration the probable increase of passengers if the reduction were made, he does not think the receipts would suffer. The Tramways Committee, after consideration of the report, decided to recommend the Council to adopt a universal system of 1d. fares, with the following scale of fares:—1d. single ticket, ½d. single ticket for children, 1d. return ticket for workmen if issued before 8.45 a.m., 2d. double return ticket for workmen if issued before 8.45 a.m., the first return half and the second outward half being available between 11 a.m. and 2 p.m. In each case the single journey to be limited to the present 1½d. distances.

Tasmania.—The Hobart ratepayers recently cast 3,439 votes in favour and 905 against purchasing the business of the Hobart Electric Tramway Co., for £210,000. The company is a British one, and owns 9 miles of tramways.

Todmorden.—At the T.C. meeting on February 27th there was a lively discussion on the motor-'bus undertaking and the proposal of the Motor-'Buses Committee to issue workmen's fares at 25 per cent. below ordinary prices. Alderman Dawson said that during the six years the 'buses had been on the roads there had been a total loss of £8,000, in spite of help from the profits on the gas undertaking. Yet it was now proposed to increase the plant and reduce the fares. Councillor Holgate contended that the 'buses should be run more for public convenience than profit. Councillor Wordsworth said the proposal for workmen's cheap fares had been on the carpet for two years, and it was time the Corporation did something. The minutes embodying the proposal and the Committee's recommendation to purchase two more 'bus bodies were adopted.

U.S.A.—A definite plan has at last been formulated with a view to consolidating all the surface and elevated traction companies in Chicago. The bodies financially interested have laid a proposition before the city authorities which will probably be subjected to a referendum vote in April next. The total surface and elevated traction mileage in Chicago is about 1,070, all of which is electrically operated. The elevated railway companies are already consolidated, and have a total property value of £15,000,000; the total capital account of the surface companies is about £28,000,000. It is proposed to issue free transfers between any of the lines in return for a 5-cent fare between any two points within the city limits. Subways are ultimately to be provided for rapid transit to all parts of the city, and the elevated railways are to be given access to a subway system, the union elevated loop being then removed.

The financial sections of the scheme provide that 6 per cent. interest shall be paid on the capital account of the properties after paying operating expenses. When the subway for the elevated trains is complete, 7 per cent. interest is to be paid on the gross total capital account. After this 7 per cent. has been deducted, the remaining profit is to be divided between the city and the consolidated company in the proportion 7: 3. The greater part of the interest allowances will go to the 5 per cent. bonds outstanding and yet to be issued. The remainder and the company's share of the surplus profits will go towards the payment of dividends and retire

the stocks of the company. The city's share will be used to wipe out the companies' bonds now issued, and yet to be issued for extensions and improvements, so that after 40 or 50 years the whole system of consolidated surface and elevated railways and subways will come into the city's possession free of encumbrance. The city authorities are to have the right of assuming ownership at any time by paying off the capital account plus 10 per cent. It is suggested that a Joint Board of Control be appointed to regulate the operation and extension of the system.—*Electrical Review and Western Electrician.*

TELEGRAPH and TELEPHONE NOTES.

Canada.—An American Consul, in Prince Edward Island, reports that important improvements are being made in the telegraph service there. A new multiple cable is to be laid across Northumberland Strait to supplement the present cable connecting Prince Edward Island with the mainland, and will cost approximately £9,000. In addition to two telegraph wires, the new cable will provide permanent telephonic communication across the strait. There are 28 telegraph offices upon the island.

China.—The Chinese Department of Communications is reported to have decided to establish a wireless telegraph station at Woosung. The apparatus will be capable of communicating in the daytime within a radius of 1,200 miles.

Imperial Wireless System.—Mr. George Balfour, prospective Unionist candidate for Govan, in the course of an address, referred to the Marconi inquiry. He said he was not entitled to say a word about the grave rumours that were in circulation regarding certain of H.M. Ministers, but he was entitled to say something regarding the manner in which His Majesty's Ministers were dealing with these accusations. The Government had appointed a Select Committee of the House of Commons. That Select Committee was necessarily a partisan Committee. That meant that the majority of its members were supporters of these very Cabinet Ministers who were involved in the accusations, while the minority was composed of their opponents. It was not good that there should be partisanship at all. The way to deal with the matter was not to appoint a Select Committee, but a Select Commission, and because of the judicial minds of the men composing it they would, as upright men, give their verdict free from bias. He asserted emphatically that the Government had failed absolutely in its duty in this respect.

International Radiotelegraphic Convention.—The United States Senate has passed a resolution approving of the Convention signed in London in July last year.

London-Berlin Telephony.—Successful experiments have been carried out in communication by telephone between London and Berlin, *via* St. Margaret's Bay and La Panne in Belgium. The length of submarine cable in circuit was 60 miles, and the total length of line nearly 700 miles. It is hoped that a regular service will be provided before long.

New Wireless Stations.—Amongst other new stations ordered from the Marconi Co. is one of 30 KW. for the Italian Government, to be erected in Eritrea. The Portuguese Government has ordered five land stations, for Lisbon, St. Miguel, Funchal, St. Vincent, and Oporto; the Brazilian Government, four land stations of 25 and 15 KW., for naval purposes; the British Government, a station for Valentia, in Ireland; and numerous orders have been placed for smaller sets, as well as for the customary 1½-KW. set and emergency set, for use on board ship.

Peru.—A proposal is before Congress to devote £17,750 to the construction of two wireless telegraph stations on the north and south coasts of the country respectively.—*The Marconigraph.*

Telephony in Mines.—A Bochum engineer, named Joseph Reineke, has devised a wireless telephone system for use in mines, on original lines. The system has been at work for the past four months with success in the "Carolinenglück" colliery at Bochum-Hamm, and the "Minster-Stein" mine is now being fitted with a similar equipment.—*Zeit. für Schwachstromtechnik.*

Wireless Time Service.—According to *The Marconigraph*, the German Imperial Post Office is about to attempt to carry out a scheme for controlling public clocks throughout the whole country by means of wireless signals sent out from the big station in Fulda, once every minute.

The "Wireless World."—This is to be the new title of the journal hitherto known as the *Marconigraph*, the organ of the multifarious interests which have grown up on the foundation laid by Mr. Marconi. The new magazine will be larger than its predecessor, and it will deal with everything of interest in the world of wireless telegraphy. The first issue, in April, 1911, consisted of 16 pages; 12 months later it comprised 52 pages, and the *Wireless World* will contain 96 pages. It will appear once a month, and will be "never at any time abstrusely technical," but will aim always to interest the general public. We wish it all success.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—March 10th. Electrical goods, for the directors of the Powell Duffryn Steam Coal Co., Ltd. Stores Manager, Aberaman, near Aberdare.

Australia.—April 14th. H.M. Trade Commissioner for Australia reports that tenders are invited for plant required to generate three-phase current for the high-power radio-telegraph station at Darwen, Northern Territory, and for lighting and power purposes in the neighbourhood. For further particulars see this column and "Official Notices" last week.

Belfast.—March 12th. The Harbour Commissioners are inviting tenders for four 5-ton electric gantry cranes for the Queen's Quay and Abercorn Basin Quay. Specifications, &c., from the Harbour engineer, Mr. W. Redfern Kelly, Belfast.

Birmingham.—March 11th. Additional rolling stock (electric tramway cars) for the Tramways Department. Mr. A. Baker, general manager, Tramway Offices, Council House, Congreve Street. (Deposit £2.)

Bridgend.—March 21st. One 400-K.V.A. steam alternator and accessories, for the U.D.C. See "Official Notices" Feb. 28th.

Brighton.—March 10th. Storage battery (800 amp.-hours) for the T.C. See "Official Notices" February 28th.

Burnley.—March 10th. Electrical work for the B. of G. for six months. Mr. J. S. Horn, clerk, Union Offices.

Chile.—September 10th. The Harbour Works authorities at Valparaiso are inviting tenders for the establishment of a central generating station for the supply of electricity for lighting and power purposes at the port.

Colchester.—March 10th. Sundry stores for the Corporation Electricity Department. Mr. W. Frisby, electrical engineer, Osborne Street.

Croydon.—March 31st. Stores for a year, for the Corporation Electricity Department. See "Official Notices" Feb. 21st.

Dover.—March 12th. Electrical sundries and cables, for a year, for the Harbour Board. Mr. Martyn Mowll, registrar, Castle Street.

Dundalk.—March 24th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" to-day.

Dundee.—The Corporation invites tenders for the construction of a brick chimney, and for the supply, delivery and erection, complete, of structural steel work for extensions to Carolina Port generating station. Mr. H. Richardson, general manager and engineer.

Eastbourne.—March 10th. Combined coal elevator and conveyor for the Corporation Electricity Department. See "Official Notices" February 28th.

Germany.—MÜNSTER.—March 15th. Tenders are invited for the supply, erection and setting at work of five electric travelling cranes of 80,000 kg. lifting capacity for the new locomotive workshops at Osnabrück. Particulars, enclosing postage (1·50 marks), from the Königliche Eisenbahndirektion, Münster, Westphalia.

POSEN.—March 17th. Supply of 22,100 metres of paper-insulated cable. Particulars, enclosing postage, from the Königliehe Eisenbahndirektion, Posen.

Heckmondwike.—Maintenance and repair of electric fire alarms, for the U.D.C. The Surveyor.

Heston and Isleworth.—March 8th. Stores and materials for a year, for the U.D.C. electricity department. See "Official Notices" February 21st.

India.—March 14th. Motors, transformer and motor-generator, for the B.B. and C.I. Railway. See "Official Notices" February 21st.

Liverpool.—March 10th. Electrical fittings for a year, for the Select Vestry. Mr. C. W. Coster, clerk, Brownlow Hill.

London.—L.C.C.—March 19th. Electrical installation at the Victory Place elementary school, Walworth, S.E. See "Official Notices" to-day.

It is proposed that during the recess, the Highways Committee shall have authority to open any tenders that may be received for the construction of the authorised conduit tramways from Catford to Southend *via* Bromley Road, and the reconstruction of the existing horse tramways from Chapel Street to Nile Street, Woolwich.

MILE END.—March 20th. Re-wiring wards, &c., at the Infirmary, for the Guardians. See "Official Notices" to-day.

According to an announcement in a daily paper, estimate, plan and drawings are invited for the following for the Anglo-German Exhibition, Crystal Palace, 1913 :—A light electric railway, connecting from the Low Level entrance to the Crystal Palace Terrace. Two escalators from the Terrace to the main building of the Crystal Palace. Offices of the Anglo-German Exhibition, Empire House, Piccadilly, W.

Macclesfield.—March 11th. Electrical goods for the Cheshire County Asylum, Parkside. Mr. Wm. Tingay, clerk of the Asylum.

Manchester.—March 12th. High-pressure steam and feed pipes for the Electricity Committee. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall. Deposit £1 1s. returnable.

Norway.—March 15th. Town Council of Narvik. 10 tons of electrolytic copper wire. Tenders for delivery c.i.f. Narvik received at "Narvik formandskab," Narvik, North Norway. Further particulars from Hr. Per Larsen, engineer, Hamar, Norway. No special form of tender is required.

Portsmouth.—March 18th. Stores and materials for a year, for the Corporation Tramways Department. See "Official Notices" to-day.

Pontypridd.—March 17th. Tramway-men's uniforms for the U.D.C. See "Official Notices" February 28th.

Southampton.—March 10th. Cable for the Corporation Electricity Department. See "Official Notices" to-day.

South Shields.—March 10th. Stores for a year for the Corporation Electricity Supply Department. Mr. H. S. Ellis, electrical engineer, Mill Dam.

Spain.—The municipal authorities of Banolas (province of Gerona) have just invited tenders for the concession for the electric lighting of the town during a period of three years.

Swindon.—March 8th. General stores and materials for a year, for the Corporation electricity and tramways departments. See "Official Notices" February 14th.

March 10th.—One 500-KW. mixed-pressure turbine and condensing plant, boiler feed pump and pipework, and one switchboard panel and cables, for the Corporation. See "Official Notices" February 14th.

March 20th.—The Standing Joint Committee of the Wilts County Council invite tenders for work in connection with the installation of electric light at the Old County Police Station, Swindon. Plans and specification and form of tender from County Surveyor's Office, Swindon.

Swinton and Pendlebury.—March 10th. One 25-KW. transformer and switchboard, main along Chatsworth Road, and annual supply of materials, for the U.D.C. Electricity Department. See "Official Notices" February 21st.

Uruguay.—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

Wallasey.—March 15th. Fuel oil (400 tons) for a year, for the Corporation electricity department. Mr. J. A. Crowther, electrical engineer, Seaview Road, Liscard.

War Office.—Cables, electrical stores, iron telegraph poles, &c. See "Official Notices" February 28th.

York.—March 10th. One 3,000-KW. turbo-alternator, with condensing plant, pipework and switchboard, water-tube boilers with chain-grate stokers, &c., storage battery and H.T. cables, for the Corporation. See "Official Notices" February 21st.

CLOSED.

Accrington.—The Tramways Department has accepted the tender of Messrs. Briggs, Jones & Gibson, for the supply of uniform clothing, and that of Messrs. Leffet & Co. for caps.

Australia.—The following contracts have been placed :—

VICTORIA.—P.M.G.

Three combined Gardner oil engines and generators (*a*) one for Thursday Island and (*b*) two for Port Moresby (Papua) wireless telegraph stations, (*a*) £283, (*b*) £252 each.—Noyes Bros.

SYDNEY.—P.M.G.

Glazed earthenware conduit, 4,000 ft.—Brunswick Brick, Tile and Pottery Works, Ltd. Ditto (about 22,000 ft.).—Mills & Co.
One X absorber, £150.—Maritime Wireless Co. (Shaw System), Ltd.

VICTORIAN RAILWAYS.—

Telephone cable.—Automatic Telephones (Australia), Ltd.
—*Australian Mining Standard.*

SYDNEY.—The City Council Finance Committee recommended the acceptance of the tender of the Australian Metal Co., Ltd., for the supply of motors for refrigerating plant at the Fruit Markets, at £2,742. The tenders of the Vacuum Oil Co., the British Imperial Oil Co. and the Pacific Oil Co. for oils were recommended. The Electric Light Committee recommended the following :—Time limit relays, Noyes Bros., £306; arc lamp contact, &c., gear, Laurence & Hanson Co., £214.—*Tenders.*

Belgium.—La Société des Ateliers de Construction Electriques de Charleroi submitted the lowest tender last week for the establishment of an electric lighting installation in the Royal Palace at Laeken, near Brussels.

Birkenhead.—Messrs. Chamberlain & Hookham's tender for D.C. meters has been accepted by the Council.

Birmingham.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract for the supply of tantalum traction lamps for the lighting equipment of the whole of the cars on the Corporation tramways system for the ensuing 12 months. During this period, it is anticipated that a quantity of some 20,000 lamps will be required.

Bolton.—The Electricity Committee has accepted the following tenders in connection with the new Back-o'-the-Bank generating station :—

John Musgrave & Sons, Ltd.—Two turbo-alternators of 4,000 KW. each.
Babcock & Wilcox, Ltd.—Four water-tube boilers including superheaters and stokers.
Green & Son.—Four sets of economisers.

China.—It is reported that a German company at Shanghai has contracted with a Chinese syndicate for the supply of electricity for lighting purposes at Wuchang.

Dartford.—The tender of the Premier Accumulator Co., Ltd., has been accepted by the U.D.C., at £723, for the supply of a battery, and for the maintenance of same for 10 years, at £65 per annum.

Derby.—The T.C. has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., for a turbo-alternator, at £7,292.

Dewsbury.—The Corporation has accepted the tender of Messrs. Ferranti, Ltd., for a switch panel for the turbine generator at the electricity works, at £266, and that of the Union Cable Co., for fire-proof cable, at £114.

Eccles.—The Corporation Public Lighting and Electricity Committee has accepted the tender of Mr. J. F. Heys for trench-cutting and cable-laying for 12 months.

The T.C. has accepted the quotation of the London Electric Firm for the supply of 13 sets of hoists and lowering-gear for the four-light clusters to be fixed on the tramway centre poles in Church Street and Liverpool Road, at £2 19s. 5d. per set.

Glasgow.—The T.C.'s Committee on Tramways has recommended the acceptance of the following :—

Steel step treads.—H. & F. Bonten, Ltd.
Armature coils.—British Westinghouse Electric, &c., Co., Ltd.
Scrap—(*a*) copper and lead.—P. & W. MacLellan, Ltd.
(*b*) brass, and (*c*) copper and mica turnings and zinc.—Pegler Bros. and Co.
(*d*) brass dust.—R. M. Easdale & Co.
(*e*) rubber.—City Waste Rubber Co.
(*f*) cable.—Ballardie, Holden & Co.

Kidderminster.—The B.G. has accepted the tender of the Birmingham Telephone Co. for the installation and maintenance of telephones in the Workhouse.

Kingston-on-Thames.—The T.C. has accepted the tender of the Craigpark Electric Cable Co. for 110 yd. of '2 sq. in. high-tension concentric lead-sheathed and armoured cable, at £52, this being the lowest of seven tenders; and that of the British Thomson-Houston Co., Ltd., for a Tirrill regulator complete, at £150. The Council has also accepted the tender of the Anglo-American Oil Co., Ltd., for up to 20 tons of fuel oil for the electricity works, at £4 3s. 6d. per ton.

Leyton.—The U.D.C. has accepted the following tenders for annual supplies :—

Oliver Arc Lamp Co., Ltd.—Carbons for lamps of own make, £2 14s. 6d. per 1,000 pairs.
Johnson & Phillips.—Second grade carbons, £3 8s. 6d. per 1,000 pairs.
Wakefield & Co.—Oil.
R. Todd.—Service line cable.

Liverpool.—The T.C. has accepted the tender of the Worthington Pump Co., Ltd., for the supply and erection of four cooling towers at the Lister Drive power station. The following tenders have also been accepted for annual supplies :—

Insulated cables and wires.—Liverpool Electric Cable Co., Ltd.; Anchor Cable Co., Ltd.
Metal-filament lamps.—The Gabriel Lamp Co.
Carbon-filament lamps.—Electrical Co., Ltd.
Carbons for arc lamps.—Wm. Geipel & Co.
Cables and accessories for mains (three years' contract).—Callender's Cable and Construction Co., Ltd.

London.—L.C.C.—The Asylums Committee has accepted the following tenders for stores :—

Electrical sundries.—General Electric Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.; Veritys, Ltd.; McLellan & Co.; Cox-Walkers, Ltd.; Edison & Swan United E.L. Co., Ltd.; Falk, Stadelmann & Co.
Electric lamps.—Siemens Bros. Dynamo Works, Ltd.; B.T.H. Co.; and G.E. Co., Ltd.

The Stores and Contracts Committee have placed contracts for electric carbons with Messrs. W. Geipel & Co. and Messrs. H. G. Mayer & Co.

After three months' satisfactory trial, which has shown that a saving in labour amounting to £100 a year will be effected thereby, an adding machine is to be purchased from the Burroughs Adding Machine Co., Ltd., for £153, for use in the tramways department.

The tenders received for three 1,500-KW. rotary converters for the Shoreditch tramway sub-station were :—

Dick, Kerr & Co., Ltd. .. .. (accepted)	£8,022
British Westinghouse Co., Ltd.	8,718
General Electric Co., Ltd.	9,145
Estimate of Chief Officer	7,900

The Committee says that the tenders are "subject to general conditions laid down by the B.E. and A.M.A.," but it sees "no objection thereto, provided the conditions in question are not materially at variance with the general conditions in the Council's form of contract."

For the wiring of the Camberwell and Cressy Road car-sheds the tenders were as follows :—

Williams & Bach .. .. .. (recommended)	£2,140
Electrical Installations, Ltd.	2,146
G. E. Taylor & Co.	2,315
G. Weston & Sons, Ltd.	2,572
Lund Bros. & Co.	2,623
L. G. Tate & Co.	2,683
Tilley Bros.	2,697
W. C. Tackley & Co., Ltd.	3,078
Estimate of Chief Officer	2,080

An agreement is to be entered into with Messrs. Thermit, Ltd., for the supply of welded rail joints, at 19s. 6d. each, during the year.

Tenders received for four towers for fitting to existing motor wagons were :—

Watlington & Co., Ltd. .. .. (recommended)	£292
Peter Boswell & Sons	379
Bayley's, Ltd.	604

Four hydraulic pit jacks for Camberwell car-shed were tendered for thus :—

National Rail and Tramway Appliances Co., Ltd. (recommended)	£35 10 each
Buck & Hickman, Ltd.	39 0 "

For smiths' hearths and exhaust and blower fans for the Leven Road, Poplar, and Battersea Wharf permanent way depôts the tenders were :—

Alldays & Onions Pneumatic Engineering Co., Ltd. (recommended)	£109
Standard Engineering Co., Ltd.	167
Geo. Hatch, Ltd.	177
Davidson & Co., Ltd. (fans only)	50
" " " " (alternatively)	48

The following tendered for 125,000 drawn-wire metallic-filament lamps :—

Siemens Bros. Dynamo Works, Ltd. .. (recommended)	£7,800
" " " " (alternative)	10,237
General Electric Co., Ltd.	10,237
British Thomson-Houston Co., Ltd.	10,237

Tenders for 380 yd. of H.T. cable were received as follows :—

Siemens Bros. & Co., Ltd. .. .. (recommended)	£248
W. T. Henley's Telegraph Works Co., Ltd.	252
Western Electric Co., Ltd.	252
B.I. and Helsby Cables, Ltd.	253
W. T. Glover & Co., Ltd.	254

For special section rolled-steel bar for magnetic brake shoes the contract is to be given to the Lilleshall Co., Ltd., at £8 2s. 6d. per ton (total £4,745). The tenders were :—

	Prices a ton, both sections. £ s. d.
Lilleshall Co., Ltd. .. .. (accepted)	8 2 6
Earl of Dudley's Round Oak Works, Ltd.	8 2 6
A. C. Schove, Purley (works - Société Anonyme d'Ougrée-Marihaye, Belgium)	8 2 9
Frodingham Iron and Steel Co., Ltd.	8 5 6
P. & W. McLellan, Ltd.	8 7 3
Andrew Brown & Co. (agents for Société Anonyme des Aciéries d'Angleur)	9 5 0
Henry Bessemer & Co., Ltd.	9 10 0
Cammell, Laird & Co., Ltd.	9 10 0
Patent Shaft and Axletree Co., Ltd.	9 12 6
Bayliss, Jones & Bayliss, Ltd.	10 7 6

ISLINGTON.—The B.C. has accepted the following tenders for annual supplies to the Electricity Department :—

Arc lamp carbons.—Sloan Electrical Co.; Geipel & Co.
Arc lamp globes.—City Glass Co., Ltd.
Electricity supply meters.—British Westinghouse Electric and Manufacturing Co., Ltd.
Cables.—British Insulated and Helsby Cables, Ltd.
Electrical sundries, lamps, brushes, arc lamp parts, &c.—Maxim Lamp Co., Ltd.; Pope's Electric Lamp Co.; General Electric Co., Ltd.; Heap and Johnson; Messrs. Round.
Cable terminal, service and network boxes, tapé, and iron castings.—B.I. and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Lucy & Co., Ltd.; Sykes & Sugden, Ltd; J. Gibbs & Co.; British Insulated and Helsby Cables, Ltd.; Dussek Bitumen Co.; India Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

SHOREDITCH.—The B.C. has received the following tenders for the supply of economisers for the boiler plant at the Whiston Street Power Station, which is invariably worked at an overload capacity :—

Economisers, Ltd. .. .. (accepted)	£1,600
E. Green & Son	1,875
E. Lowcock, Ltd.	2,097
Clay Cross Co.	2,350
E. Goodbrand & Co.	2,370
J. Thompson	2,500

Staffordshire.—The County Education Committee has accepted the tender of the Electric Construction Co., Ltd., at £365, for the installation of electric plant and machinery, &c., for the Burntwood, Chase Town, New County Mining Institute.

Rochdale.—The Corporation Gas and Electricity Committee on Friday decided to recommend the acceptance of the following tenders in connection with the extensions at the electricity works :—

Building.—R. & T. Howarth.
Turbo-alternator.—W. H. Allen & Co.
Steam turbine.—J. Howden & Co.
Motor-alternator.—The General Electric Co., Ltd.

The contract for boiler and hoppers was left over for further consideration.

Warrington.—The T.C. has accepted the tender of Messrs. T. Speak for wiring the new baths.

Wigan.—The T.C. has accepted the tender of Messrs. Dorman & Smith for a new switchboard for the Market Hall.

FORTHCOMING EVENTS.

Royal Institution.—Friday, March 7th. At 9 p.m. Discourse on "Photography of the Paths of Particles Ejected from Atoms," by Mr. C. T. R. Wilson.

Saturday, March 8th. At 3 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture V.)

Saturday, March 15th. At 3 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture VI.)

Charing Cross, West End and City Electricity Supply Co., Ltd.—Friday, March 7th. At 8 p.m. Staff Smoking Concert. The Pillar Hall, Victoria Station (S.E. and C. Railway).

Association of Electrical Station Engineers.—Friday, March 7th. At 8 p.m. At Exeter Café, Deansgate, Manchester. Meeting to form Manchester branch.

Wednesday, March 12th.—At 7.45 p.m. At the Y.M.C.A., Bothwell Street, Glasgow. Meeting to form Glasgow branch.

Junior Institution of Engineers.—Friday, March 7th. At 39, Victoria Street, S.W. Paper on "The Training of a Colonial Engineer," by Mr. A. C. Herapath.

Wednesday, March 12th. At 8 p.m. At the I.E.E. Paper on "Water-Heat-steam: the Effects of Heat upon Water, and a Consideration of Water Movements in Steam Boilers," by Mr. A. Ross.

Friday, March 14th. At 39, Victoria Street. Continuation of discussion on paper on "Water-Heat-Steam."

Institution of Post Office Electrical Engineers (Metropolitan Section).—Monday, March 10th. Meeting at 6 p.m. At the I.E.E.

Faraday Society.—Wednesday, March 12th. At 4.30 p.m. At the Chemical Society rooms, Piccadilly, W. General discussion on "Colloids and their Viscosity."

Association of Engineers-in-Charge.—Wednesday, March 12th. At 7.30 p.m. At St. Bride's Institute, E.C. Paper on "The Province of the Engineer-in-Charge," by Mr. A. E. Penn.

Institution of Electrical Engineers (London).—Thursday, March 13th. At 8 p.m. Paper on "Power Supply on the Rand," by Mr. A. E. Hadley.

(Newcastle Section).—Monday, March 10th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Condensing Plant," by Mr. W. A. Dexter.

(Manchester Section).—Tuesday, March 11th. At 7.30 p.m. At the University, Manchester. Paper on "Power Supply on the Rand," by Mr. A. E. Hadley.

(Scottish Section).—The meeting set down for Tuesday, March 11th, has been postponed to March 18th, and the annual general meeting from April 8th to April 15th.

(Yorkshire Section).—Wednesday, March 12th. Meeting at 7 p.m. At the University, Leeds.

(Birmingham Section).—Wednesday, March 12th. At 7.30 p.m. Meeting at the University, Birmingham.

(Dublin Section).—Thursday, March 13th. Meeting at 8 p.m. At the Royal College of Science, Dublin. Paper on "Recent Developments in the Application of Electricity to the Textile Trades," by Mr. S. F. Crowley.

Physical Society.—Friday, March 14th. At 5 p.m. At the University College, Gower Street, W.C. Paper on "Some Oscillograms of Condenser Discharges and a Simple Theory of Coupled Circuits," and "An Exhibition of Braun Cathode-Ray Tubes and an Electrostatic Machine for Working them, used as a High-Frequency Oscillograph," by Prof. J. A. Fleming; and other papers. Demonstration of Spark Photographs, by Mr. W. B. Haines, before the meeting.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, March 10th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, March 11th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, March 13th.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Friday, March 14th.—"D" Company. Company training, 7 to 10 p.m.

Saturday, March 15th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.
For Officer commanding L.E.E.

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NOTES.

The Easter Holidays.—Owing to Friday, March 21st, being Good Friday, the ELECTRICAL REVIEW for that date will be published two days earlier, appearing on the morning of Wednesday, March 19th. Our advertisement department asks that new advertisement copy and alterations to existing advertisements for that issue should be received not later than Saturday morning, March 15th. An announcement on the matter will be found in our advertisement pages to-day.

Cost of Operating Electric Wagons.—The Commonwealth Edison Co. has published interesting schedules showing the cost of operating two 700-lb.; four 15,000-lb.; four 2,000-lb.; and 20 3,000-lb. electric wagons during the three years, January, 1909, to December, 1911. Nineteen of the vehicles have Edison, and the remainder lead batteries. From these returns (published in the *Electrical Review and Western Electrician*), we extract the following average data:—

Item.	Average cost. Per car per mth. s. d.	Per car-mile. d.
Fixed charges*	126 6	2·0
Fixed charges on land, buildings and garage..	24 0	0·4
Operating expenses† ..	582 0	9·15
Total general expenses‡	67 10	1·05
Grand total ..	800 8	12·6
Miles travelled per car per mth. =	775	
Miles per day per wagon in service .. .. =	30·5	
Days per month in service (per wagon) .. .. =	22·6	
Average KW.-hr. per car-mile.. =	0·495	

Item. Including:—	Average cost. Per car per mth. s. d.	Per car-mile. d.
Oil and other supplies ..	21 2	0·35
Energy at 2d. per unit ..	63 0	1·00
General repairs	55 5	0·85
Tires	36 8	0·55
Batteries	40 11	0·65
Total..	217 2	3·40

* Interest at 6 per cent.; taxes, 1·5 per cent.; insurance, 2 per cent.; depreciation, 10 per cent. † Including driver's salary, washing, oiling and minor repairs and operating garage expenses. ‡ Including supervision, wheel tax, licence and insurance.

It is said that the 1912 operating costs were lower than the above, but no precise figures for last year have yet been published. It should be noted that the figures apply to American conditions, and probably lower figures would be obtained in this country.

A Powerful Sterilising Mercury-Vapour Lamp.—In the types of mercury-vapour lamps hitherto in use, the electrodes have been at opposite ends of a straight tube, the enlargements, condensing chamber or radiating vanes of which have prevented close approach of the luminous part of the lamp to objects that are to be illuminated. With a view to removing this limitation and securing a much higher percentage of ultra-violet light than is provided by ordinary 110—220-volt mercury lamps, Messrs. Henri, Helbrunner & Recklinghausen have constructed a lamp in which the luminous vapour is contained by a quartz U-tube. The internal diameter of the tube is 0·55 in., each limb is 6·3 in. in length, and the two limbs and the electrodes are very close together. The lamp operates on 500 volts, the P.D. between the electrodes being 375—390 volts and the current flowing 3 amperes. The net power consumption of the lamp is thus 1,150 watts, and the candle-power, in a plane through the centre of the arc perpendicular to the axis of the lamp, exceeds 8,000 C.P.

The absolute value of the ultra-violet radiations has not yet been determined, but their chemical and bacteriological effects have been compared with those radiations from 110 and 220-volt lamps. It is reported that the new 500-volt lamp produces the same effect on amidon in six hours and on glycerine in four hours, as is produced by a 110-volt lamp in 260 hours and 240 hours respectively. The sterilising effect of the new lamp on a bacteria culture (*coli*) is 60 times as rapid as that of a 110-volt lamp placed at the same distance from the culture. Considerable photo-combustion and photo-polymerisation of carbides of hydrogen have been effected by the new lamp, whereas such action is very limited if 110-volt lamps be used.

The new lamp provides ultra-violet radiations from 50 to 60 times as intense as those from a 110-volt lamp (though its wattage is only 4·6 times as great). When applying the lamp to the economical sterilisation of large quantities of water, the luminous portion of the tube is enclosed by a cylinder of transparent quartz fixed at the centre of a circular tank, through which flows the water treated. Baffle plates are provided to guide the water round and against the central cylinder.—*Technique Moderne.*

"New Light Marvel."—Under this title the *Standard* recently put before its readers an account of a "discovery" made by a French engineer, M. Dussaud. The description ran as follows:—

The invention is based on the principle of matter having need of rest, or molecular equilibrium. For example, two springs working alternately wear out more slowly than if each is worked continuously. "Cold light" is the application of this principle to incandescent electric lamps. Light is concentrated in a single point by all the filaments working successively, and projected through a lens multiplying a thousandfold. By this process M. Dussaud has succeeded in concentrating 2,000 C.P. in a single point and passing 32 volts into an 8-volt lamp, which otherwise would burst.

The advantages claimed are, first, the elimination of danger, since a lamp, though producing so dazzling a light that it is impossible to look at it with the naked eye, can be held in the hand without the slightest heat being felt. Second, such a lamp requires a hundred times less current than the ordinary lamp, and in the absence of a sector it can be produced by a tiny battery. The motive power can be given by an ordinary water tap, a squirrel in a cage or the operator's foot. Third, it contains ultra-violet rays, thus requiring a hundred times less electricity than usual.

These facts were all demonstrated on the screen. A beautiful coloured landscape, 3 yards square, to project which with ordinary lamps would require 40 volts, or 2,000 watts, only needed 20 watts with the "cold light," costing one centime instead of a franc, or a hundredth of the cost. All the views shown were produced with very small and inexpensive apparatus, and henceforth similar illustrations can be given in schools by professors without danger, the only appliance being a cheap little apparatus that can be slipped into the pocket.

We need not follow the enthusiastic correspondent of the *Standard* further. Those of our readers who remember our exposure of the analogous "Poleforcia" fallacy will not be surprised to know that we regarded this report with the coldest scepticism, and we did not publish anything about it. In the meantime, we have communicated with a distinguished French scientist, who informs us that there is no foundation for M. Dussaud's extravagant claims—backed though they were said to be by no less eminent a physicist than Prof. Branly—except the statements of the inventor himself, who has produced no evidence in support of them

Electrical Trades Union.—Under the auspices of the Plymouth Branch of the Electrical Trades Union, a smoking concert was held at the Clarence Hotel, Morice Town, Devonport, on Friday evening. There was a good attendance, and the general organiser (Mr. J. Hinniburgh) attended and addressed the members on the importance of organisation. He pointed out that it was impossible to get the old men employed in the Dockyard to see the benefits of Trade Unionism. The reason was that they were all right themselves and did not care twopence for any of the other workers. He therefore made an appeal to the young men, those hands who had come around from Scotland, the North of England and London, to join the organisation, and then band themselves together with the hope of making the electrical trade better in the future than it had been in the past. Organisation or combination was absolutely essential for the self-preservation of the individual. The speaker observed that the members of the House of Commons fixed £400 a year as the minimum rate of wages on which they could exist. Supposing those 700 gentlemen suddenly dropped dead, no one would be put about much except their near relatives. For any real necessity they would not be missed at all. But take the working classes. Supposing 700 bakers in the Three Towns were suddenly to drop dead. They could easily understand what a serious position would be caused thereby. The 700 bakers were far more necessary than the 700 gentlemen who legislated for their country at Westminster. The speaker reminded his hearers of the campaign to be initiated shortly for an 8-hour day. That matter might not interest those engaged in the Dockyard, but those working outside the Dockyard would recognise that an 8-hour day was a big proposition.

Subsequently Mr. T. Parr, who has held the office of secretary of the Plymouth branch for the past five years, was the recipient of a fountain pen in recognition of services rendered.

Gas Fires and Evil Odours.—In a leaderette on "The Education of the Gas Consumer," our contemporary, the *Gas World*—for which, by the way, we have sincere respect—courageously publishes some plain truths about the gas fire; as our contemporary occasionally does us the honour to quote from our columns, we return the compliment:—

"The truth of the gas fire situation, as it is capable of being realised to-day, is precisely as Mr. Wilson put it:—No gas fire ought to announce its existence through the sense of smell. Unfortunately, very many gas fires do so betray their defective construction or fitting. It is high time that this deplorable misbehaviour of gas fires were corrected."

"Mr. Wilson speaks of tracing our complaints; but the right rule is not to wait for complaints. All experience shows that absence of complaints is no proof of want of cause for them."

"Many gas consumers are quite resigned to the evil odour of a badly-adjusted boiling ring, or a smothering gas fire. So they will go on, until a case of sickness requires the doctor's visit; and the first thing he does is to condemn the stove or the fire. The degree of toleration of a bad gas smell varies considerably in different people, and an inspector with a keen nose for it is worth money to a gas undertaking."

We agree with every word of these extracts, except, perhaps, the last line or two. If there is real value in a keen perception of a bad gas smell, we ought to be worth a mint of money if we were inspectors.

Electrical Progress in Russia.—With a view to ascertaining the position of municipal supply in Russia, the town of Ivano-Vosnesensk (says the *Financier*) has instituted inquiries as to the working of central stations in nine towns, Pensa, Wilna, Viatka, Nerechta, Tula, Kischinev, Stavropol, Minsk, and Astrakan. Presumably information was gathered from towns more or less resembling Vosnesensk in conditions or population, or from the sources where it was most readily available, as this list does not, of course, include the largest towns in Russia, which are lighted by electricity. (If this is Vosnesensk on R. Bug, the population at the last census was 107,000; that of Pensa, 79,000; Wilna, 184,580; Tula, 130,800; Kischinev, 118,807; Stavropol, 54,800; Minsk, 97,990;

and Astrakan, 149,600.) In eight of the nine towns mentioned, the stations were working successfully, and contributing to public revenue. The net profits were as follows: Wilna, 85,000 roubles (say, £8,000); Minsk, £5,800; Astrakan, £4,100; Tula and Pensa, £3,800; Viatka, £2,900; Kischinev, £2,600; and Stavropol, £1,400. In manufacturing, Germany has all the most important electrical concerns, as the Russian General Electric, the Russian Siemens & Halske, and the Russian Schuckert Co. There are two other large houses—the Russian Tudor Accumulator Co., and the Volta. These concerns have a combined capital of 16,800,000 roubles (£1,600,000), which is about 85 per cent. of the capital of the 10 existing electrical concerns in Russia. The Schuckert now proposes an extension of capital of 12,000,000 roubles, and the General Electric is extending its capital 4,000,000 roubles. In 1912, the branches of the Siemens & Halske firm in Poland were transformed into an independent establishment.

Electricity from Cinders.—The cinders deposited in locomotive smoke boxes are a fuel of considerable value, since its calorific power is equal to 4,500 to 6,000 calories per kg. Till lately its utilisation has defied every attempt of the many experimenters with it. Recently, however, the firm of J. Pintsch, of Berlin, has succeeded in overcoming the difficulties attending its gasification, by means of a specially devised producer. Several of these have been acquired by the Prussian State Railways, for the production of electric current, which is used to light railway stations and workshops. In practice it is found that 1·5 to 1·6 kg. of cinders is needed to produce a kilowatt-hour. First cost charges are from 1,097 fr. to 1,305 fr. per KW. Working costs range from 0·0325 to 0·055 fr. per KW.-hour, exclusive of charges for sinking fund and interest.—*Revue Electrique.*

Fatalities.—A correspondent states that at the Helsby Cable Works, Charles Antrobus was working in the cable testing department, on Friday morning, when he came in contact with a live wire. He was killed instantly.

A Sheffield paper says that while following his employment as a coal-cutting machine driver at Houghton Main Colliery, on Saturday, Joseph Bains (26), of Middlecliffe Cottages, Houghton Parva, was killed by an electric shock.

The *Cape Times*, just to hand, reports that on February 3rd, at Johannesburg, Winter Hart (34), who held the position of assistant distributing engineer in the electrical department of the municipality, was killed while on duty. Hart was inspecting work under his supervision. The Parktown high-tension side of a transformer kiosk was open, and, in the execution of his duty, Mr. Hart, in some inexplicable manner, came into contact with the high-tension terminals at a pressure of 3,300 volts alternating at 50 cycles periodicity, and he was killed instantaneously. He was very badly burnt about the chest. The usual methods of artificial respiration were kept up for over half an hour, with no beneficial result. He leaves a young widow and a baby six weeks old. Verdict, "Death from misadventure."

Annual Socials and Dinners.—LONDON.—On Saturday, February 22nd, the members of the Kensington and Knightsbridge Electric Lighting Co.'s Cricket Club held their eighth annual concert at the Constitutional Club, Hammersmith. The chair was taken by Mr. H. W. Miller, supported by Messrs. C. L. Lichtenberg, R. W. Roberts, G. C. Weston and A. France. The whole of the arrangements were carried out under the management of Mr. A. C. Adams, the M.C. for the evening, assisted by Messrs. G. Gilbert, Gammage, Ashpool and R. Mitchell and other members of the Club. The concert was preceded by a whist drive. The winners of the whist drive prizes were as follows: Ladies—Mrs. Enderwick, Bishop, Godfrey and Stebbings; Gentlemen—Messrs. Biddlecombe, Stenning, Featherstone and Shea. There was a half-an-hour's interval between the drive and concert for refreshments, which were supplied by the steward, Mr. Goodchild. Mr. Frank Mitchell and Mr. Spriggs entertained with humorous songs; Mr. G. Gilbert, with mandoline solos; Miss Gillies, Miss Hammond and Mr. E. Driver sang, and Mr. Carter gave sifflleur performances. Mr. F. C. Mitchell presided at the piano. The Cricket Club prizes were presented by the president, Mr. H. W. Miller. The winners were as follows: Mr. A. France and L. S. Fosbrooke shared the "A" XI batting prize; Mr. A. Waters, "A" XI bowling; Mr. O. A. Bartlett, "A" XI fielding; Mr. A. Cox, "B" XI batting; Mr. A. Jolly, "B" XI fielding prize. No member qualified for the "B" XI bowling prize. A vote of thanks was proposed by Mr. Gammage to the president of the Club for presiding; this was received with hearty applause, and the chairman responded. A vote of thanks was then proposed to Mr. A. C. Adams for so excellently carrying out the arrangements; Mr. Adams replied, and in turn thanked the artistes and the stewards.

LONDON.—The annual dinner of the staff and other employés of the Westminster Engineering Co., Ltd., of Willesden Junction, was held on Saturday, March 1st, at the Bush Hotel, Shepherd's Bush. A capital musical programme, provided mainly by the employés of the company, followed. The chair was occupied by Mr. J. O. Girdlestone. Mr. W. Meacher proposed the health of the staff.

EDINBURGH.—The annual staff ball of Bruce Peebles & Co., Ltd., was held last Friday evening at the North British Station Hotel, Edinburgh, and, as usual, a large gathering was present. Sandwiched between the two halves of the dancing programme was the supper, to which about 150 individuals sat down, these including guests and members of the staff and works. The usual toasts were proposed, the chairman (Mr. Lee Murray) proposing "The King." Mr. R. Graham proposed "The Firm of Bruce Peebles & Co., Ltd." Mr. Alex. Mackenzie (director) replying. Mr. J. H. Bunting proposed "Our Guests," and on behalf of the guests Mr. Alex. Robertson-Durham replied; but the toast of the evening was that of "The Chairman" (Mr. Lee Murray), proposed by Mr. S. E. Bastow, who, in the course of his remarks, took the opportunity of making a presentation to Mr. Murray, who has just retired from the position of general manager, having been appointed to a seat on the board of directors. The presentation took the form of an album handsomely bound in full morocco and containing, in addition to an illuminated address, the signatures of between six and seven hundred members of the staff and works. Mr. Murray suitably replied, and emphasised the importance of giving to the new joint general managers, Mr. S. E. Barstow and Mr. J. H. Bunting, the same support which had been loyally given to him during his whole tenure of office. There was an optimistic tone about all the speeches, and it was pointed out that not only were orders being received from new customers at home and abroad, but repeat orders from all old customers were being continually received. Dancing was continued until the small hours of the morning.

The annual smoking concert of the Great Eastern Railway Electrical Engineers' Department will be held at the Great Hall, Cannon Street Hotel, on Saturday, April 19th, at 7.30 o'clock p.m. Mr. H. W. Firth, M.Inst.C.E., will preside.

The staff smoking concert of the Charing Cross, West End and City Electricity Supply Co., Ltd., will be held to-night at 8 o'clock, at the Pillar Hall, Victoria Station.

Change of Name.—With its April issue our United States monthly contemporary, *Southern Electrician*, will change its name to *Electrical Engineering*, representing the consolidation of the *Southern Electrician* and the *Electrical Age*.

Institution and Lecture Notes.—ROYAL INSTITUTION.—The following are included in the lecture arrangements after Easter:—Prof. W. J. Pope, three lectures on Recent Chemical Advances: (1) Molecular Architecture; (2) Chemistry in Space; (3) The Structure of Crystals. Mr. H. A. Humphrey, two lectures on Humphrey Internal Combustion Pumps. Prof. E. Rutherford, three lectures on Radioactivity: (1) The Alpha Rays and their connection with the Transformations; (2) The Origin of the Beta and Gamma Rays and the connection between them; (3) The Radio-Active State of the Earth and Atmosphere. The Friday evening meetings will be resumed on April 4th, when Mr. James J. Dobbie will deliver a discourse on the Spectroscope in Organic Chemistry.

JUNIOR INSTITUTION OF ENGINEERS.—On Wednesday, March 12th, at 8 p.m., at the Institution of Electrical Engineers, a paper will be read on "Water-Heat-Steam: The Effects of Heat upon Water and a consideration of Water Movements in Steam Boilers," by Mr. Arthur Ross, F.I.C., F.C.S. The paper will treat of the behaviour of water (1) when heated at atmospheric pressure:—Convection; conduction; steam; spheroidal water. (2) In a boiler working at high pressure:—When lighting up boiler; when steaming lightly; when steaming hard; the effects of hindering free discharge of steam; priming. These points will help in the explanation of:—Grooving; pitting and corrosion; the effect of zinc plates.

ELECTRO-TECHNICAL ASSOCIATION, BRADFORD.—On Monday evening, February 24th, at the Royal Hotel, Bradford, an interesting lecture was given by Dr. Robert Pohl, chief engineer to the Phœnix Dynamo Manufacturing Co., Ltd., entitled: "What are the Output Limits of Electrical Machines?" The lecture was well attended by members of the Association, and after a discussion on various points a hearty vote of thanks was accorded to the lecturer.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.—This Association will hold its annual gathering in Blackpool, on June 12th and 13th next. It is expected that from 150 to 200 delegates will attend. The Blackpool and Fleetwood Tramroad Co. will entertain the members, who will also have a trip on the St. Anne's and Lytham line. The Finance Committee decided, on February 27th, to entertain the members at dinner, and the expense will be provided for in the salary of the Mayor, voted to him in connection with the King's visit.

INSTITUTION OF CIVIL ENGINEERS.—A paper was read at the meeting on Tuesday last, entitled "Notes on City Passenger-Transportation in the United States," by Mr. G. D. Snyder.

SOCIETY OF ENGINEERS (INC.).—In the inaugural address of the president, Mr. Arthur Valon, A.M.Inst.C.E., delivered on Monday last, the author said that the development of engineering during the past 20 years had wrought a great change in the personnel of the profession. When engineering was almost entirely a matter of practical experience, professional qualification was independent of general education; but now that rational methods of calculation and design had superseded those of empiricism, a complete knowledge of these principles was necessary to every engineer, so that the system of apprenticeship no longer completely met educational requirements. The requirements for modern engineering training were contrasted with those of 20 years ago, and it was shown that a great increase had taken place in the number of engineers occupying more or less subordinate positions, for which technical competence was a greater recommendation than personal initiative.

THE CONCRETE INSTITUTE.—A paper by Mr. John A. Davenport, entitled "Economy in Reinforced Concrete Design," was read at the meeting on February 27th. The next meeting of the Institute will take place on March 13th, when a paper will be read by Mr. H. C. Johnson on the subject of "The Strength of Cement." The total membership of the Institute is now 968; when the membership reaches 1,000 an entrance fee, which at present is not required, will be imposed.

Institution of Electrical Engineers (Newcastle Local Section).—Arrangements are being made for a visit to works in the Middlesbrough district on Wednesday, April 9th, to be followed, at 7 p.m., by a meeting, at which Mr. A. E. Hadley will read a paper on "Power Supply on the Rand."

Mr. S. L. Pearce, electrical engineer to the Manchester Corporation, will deliver a lecture at the Municipal Evening School of Commerce, Manchester, on Monday next on the work of the electricity department.

On Wednesday last a paper was read by Mr. E. L. Pope before the L.C.C. Tramways Engineering Society on "The Equipment of Electric Tramway Conduit."

Copper.—It is gratifying to note an increase in the production of any European country, and the figures relating to Russian output during 1912 given in the *Financier* of February 24th show remarkable progress. The production for the first 10 months of 1912 is given as 1,698,000 poods (say 27,300 tons) over the corresponding period of 1911; this shows an increase of 34·4 per cent. The district with the highest production is the Ural range, with 14,700 tons; the Caucasus contributes 7,800 tons, Siberia 3,800, and 1,080 tons come from the chemical works and refineries. The increase in the Urals is 42·5 per cent. (for the period taken, compared with the same period in 1911). The leading company is the Kyshtim Corporation (Urals). Sisserts factories also show a large increase. In the Caucasus the Caucasian Copper Co. and the Synnika factory have largely increased their output. In Siberia, the Spassky Co., with an output of 3,500 tons, shows an increase of 33 per cent. over that of 1911. The Yenissei Co. shows a drop on its small production—436 tons to 226 tons.

The hardening in the price of copper is ascribed to better prospects of peace in the Balkans, and should be confirmed by the removal of the strike depression at home. The decrease in visible supplies during February (England, France, and afloat thereto from Chile and Australia) was 2,052 tons, the greater part of which is from English ports; French stocks were only 194 tons less, and the quantities afloat amounted to 375 tons less than on January 31st. Rotterdam has increased stocks by 2,700 tons, and Hamburg by 924 tons, the total European visible supply being thus 1,572 tons better than on January 31st.

In detailed supplies (quoting, as usual, from Messrs. H. R. Merton and Co.'s circular) arrivals from North America were up to average, Spain and Portugal very low, Chile shipments below average, and Australian just on. Total deliveries at 38,599 tons are (allowing for the short month) up to the average of the past 12 months, which, however, is 1,500 tons below that of the 12 months preceding them (*i.e.*, the greater part of 1911, and two months of 1912). American stocks (American Producers' Association figures) were 7,986 tons better on January 30th than at the end of December, the world's supply standing (January 30th) at 93,198 tons, or 5,825 tons above the preceding month.

The British Fire Prevention Committee's Testing Station.—Owing to the greater demands made upon the Committee for testing facilities, it has been decided to enlarge the testing station and to add to the Committee's plant. The main building is also being rearranged in such a form that the principal rooms will be available for the Committee's interesting technical and historical collections. It is anticipated that the alterations will be completed early in April, when the testing operations of the new session will be commenced. Apart from the usual applications for fire tests emanating from Great Britain and the Colonies, there is a marked increase in the requests for tests from Germany and from the United States, where the Committee's reports also enjoy the recognition of the public authorities.

The Expert and the Witness.—Mr. John Emanuel Mackey, M.L.A. (Vic.), who was chairman of the Select Committee which was appointed to inquire into Mr. Merz's electrification scheme for the Melbourne metropolitan railways, is feeling somewhat sore concerning an incident of the inquiry which is vastly amusing to everybody else. Mr. Mackey, who was a very strenuous worker in his University days, and carried off many honours and scholarships, determined to get right to the bottom of this electrification business before he entered upon his responsible duties as chairman of the Committee, and with that end in view, it is said that he spent much midnight oil in mastering the contents of an elaborate article on electrification, which forms part of an important scientific encyclopædia.

Crammed with new and half-digested scientific knowledge, Mr. Mackey adopted a very stern attitude towards Mr. Merz when the latter appeared before him as a witness. Mr. Mackey cross-examined Mr. Merz on every detail, turning him inside out, and determined to catch him tripping if it were possible. Finally, it is said, Mr. Mackey quoted the authority which he had been consulting, and asked Mr. Merz if he agreed with the conclusions of the writer of the article. "Yes," said Mr. Merz demurely, "I quite agree with him. In fact, I wrote the article on which you have been examining me, myself." A broad smile illumined the faces of all Mr. Mackey's fellow committeemen, but since that time the chairman himself has looked upon electrification with a jaundiced eye.—*British Australasian.*

The Dynamicables.—The Dynamicables anniversary dinner will take place on Wednesday, April 2nd, at the Trocadero Restaurant, at 7.30 p.m. Mr. J. E. Kingsbury will be in the chair.

Ten Years in the Norwegian Nitrate Industry.—February 13th, 1903, was a noteworthy date in the history of the nitrate industry, because it was on that day that Prof. Birkeland and Engineer S. Eyde met together and came to a final decision with regard to the problem of extracting nitrogen from the air. There is no industry which can show a similar development in the course of such a short period as 10 years. The start was made with a couple of men, and the total amount of power employed was no more than 5 H.P. On February 13th, 1913, there were employed about 400 engineers and officials and more than 2,000 workmen, while the amount of electrical power used had risen to 200,000 H.P. As a result of this activity, there has grown up a new town of the name of Notodden, which has a population of between 4,000 and 5,000 and which recently obtained all the rights of a town. Another community which has grown up in the same neighbourhood, viz., Rjukan, also will shortly obtain official recognition as a town.

Manufacturing in Russia.—The question of the utilisation of the power of the small Imatra Falls in Finland, to which reference has been made on former occasions, now appears likely to form a matter of dispute. A concession for the right of use of the falls was secured some time ago by the St. Petersburg (1886) Electric Lighting Co., which proposes to erect large hydro-electric works for the transmission of energy to St. Petersburg for its own services, and for those of the other two supply companies in the capital. But the Government of Finland now wishes to retain possession of the Imatra Falls, and also to utilise the Rouhiala Falls in connection with the suggested conversion of the Finnish railways to electric traction. German financial interests who are concerned with the three supply companies in St. Petersburg contend that if the Government of Finland intends to prevent the use of the Imatra Falls, it will be necessary for it to pay full compensation to the lighting company of 1886 on account of expropriation. The point in dispute is so delicate that future developments cannot fail to be of interest, especially as German firms expect large orders to result from the Finnish hydro-electric undertaking for the additional requirements of St. Petersburg.

An Electric Dinner.—An informal all-electric dinner at "Tricity House," 48, Oxford Street, W., on March 14th, is the latest venture on the part of the Students' Section of the Institution of Electrical Engineers. The dinner is open to all Students and their friends, and tickets (price 2s. 6d. each) are to be obtained from the hon. secretary of the Students' Section, Mr. E. T. Driver, 24, Bradgate Road, Catford, S.E.

Inquiries.—Makers of "Rosalin" soldering paste, and makers of chains, 14 and 16 gauge, are asked for.

Appointments Vacant.—Electrician for the Cornwall County Asylum (24s.); sub-station foreman, for the Shanghai Municipal Council; Meter tester, for the Birmingham Corporation (30s.). See our advertisement pages in this issue.

The Electrical Iron Industry in Norway in 1912.—There are now three electrical ironworks in operation in Norway. The new industry has met with difficulties, and, as compared with the electrical iron industry of Sweden, it has made slower progress. The first works set in operation were the Hardanger Electrical Iron Works. The process employed at these works is that of the Swedish Co. "Electrometal," which was demonstrated at the Trollhättan Works. The total production of electrical pig-iron in 1912 amounted to 2,200 tons, and the number of men employed to 55. At the Ulefos Iron Works there is also a small electrical plant in operation. The production of electrical pig-iron in 1912 was 300 tons, which was used in the foundry belonging to the iron-works. The Tinfos Electrical Iron Works have now at last been able to make a start, after the completion of the plant, which was delayed for a whole year on account of late deliveries of machinery and materials, while they also were kept waiting a long time for the necessary permission from the Government to erect the cable for the transmission of energy. At the end of the year there were two out of three furnaces in operation. The production of each has averaged about 10 tons of pig-iron per 24 hours, which, roughly, would give an annual production of 3,000 tons per furnace, or 9,000 tons for the whole plant. The process employed at these works is the invention of a Norwegian engineer, B. Lorentzen, and the products obtained have proved to be of excellent quality. The total production of electrical pig-iron in 1912 was thus rather more than 3,000 tons.

The Stavanger Electro-Steel Works at Jörpeland, in the neighbourhood of Stavanger, have also experienced some delay, but have now been completed and started. The necessary power is derived from the Ryfylke Waterfalls, and 1,500 H.P. are, in the first instance, going to be employed. The annual production will, according to the estimate, be about 6,000 tons of steel, which will be produced from scrap iron, chiefly from old ships, which is first melted in a Martin furnace, and afterwards refined in an electric furnace. The electric furnace has already been tested. A forge is also going to be built in connection with the steel works.

Electric Smelting of Iron Ore.—According to the *Revue Electrique* there are only six existing electric furnaces for the production of iron by the direct treatment of the ore, viz.:—Four in Sweden: Trollhattan (2,500 H.P.), Domnarfvet (3,500 H.P.), Hagfors (two of 3,000 H.P. each); one in Norway (Hardanger, 3,500 H.P.) and one in California (Heroult City, 3,000 H.P.). Five other furnaces are nearly completed—one of 3,500 H.P. at Hardanger (Norway), three of 3,000 H.P. at Arendal (Norway), and one of 2,500 H.P. in Switzerland. The total power engaged in iron smelting with the electric furnace is at present about 32,500 H.P.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials. — Our note of last week with reference to Mr. "J. Phillip" contained inaccuracies. MR. A. D. PHILLIPS, assistant manager of the Fife Electric Power Co., who has just secured the appointment of engineer and manager to the Derbyshire and Nottinghamshire Electric Power Co., has occupied his position at Dunfermline for the past seven and a half years. He went there from the Glasgow Corporation Electricity Department, not from Dundee as stated by us.

The staff of the Cardiff Corporation Electric Light and Tramways Department has presented a solid silver salver to the engineer and manager, MR. ARTHUR ELLIS, as a token of esteem and respect.

MESSRS. A. SADLER, of Messrs. Chapman & Hall, engineers, and H. STEAD, of Linkfield Road, Isleworth, have been appointed to positions on the works and office staffs respectively of the Heston-Isleworth Council's electricity undertaking.

Among a number of increases of salary granted to Corporation officials by the Wrexham Town Council, was that of the electrical engineer, from £250 to £275 per annum.

At a special meeting of the Electricity and Tramways Committee of the Heywood Corporation on Monday, a letter was received from MR. JAMES STOTT, resigning his position as electrical engineer and manager, on account of ill-health. The resignation was accepted. Mr. Stott has held the appointment for a number of years.

Tramway Officials.—The Bury Corporation Salaries Committee recommends the T.C. to advance the salary of the tramways manager, MR. WM. CLOUGH, from £400 to £450, with a further advance to £500 at the end of another year.

MR. L. C. F. BELLAMY, of Liverpool, has been appointed tramways engineer to the Ilkeston Corporation. Mr. Bellamy has for three years been assistant manager to the tramways at St. Helens.

MR. CHARLES MITTELHAUSEN, who has recently resigned his position as engineer and manager to the Bexley Council Tramways and Electricity Undertaking, was entertained to dinner on February 28th, at Whitehall Court, by the tramways managers of the greater metropolitan area. The chair was occupied by Mr. H. E. Blain, West Ham, other present including Messrs. A. Coveney (Erith), S. Dudman (Dartford), W. E. Hammond (Metropolitan Electric), L. E. Harvey (Ilford), A. V. Mason (South Metropolitan), F. Schofield (Leyton), H. P. Stokes (Bexley), and W. C. Ullman (West Ham). Messrs. Goodyer, Holmes, Murray, and Pott were unavoidably prevented from attendance. All present expressed, in very warm terms, their appreciation of Mr. Mettelhausen's official and personal qualities, and their good wishes for his health and success in his new sphere.

General.—A correspondent writes: "It will interest your athletic readers to know that MR. PERCY MITCHELL, who acts as business manager for Mr. Cleave (Messrs. Drake & Gorham's Bristol agent), was selected to play centre forward for Gloucestershire in the Association football match, Dorset *v.* Gloucestershire on the Bristol City ground on February 26th. In one of the reports of the match Mr. Mitchell is referred to as follows: 'The score was equalised after clever work initiated by Mitchell, of St. Andrew's. He ran with the ball for 20 yards, and when he was tackled by Brown, Shervy got possession and passed to Powell, who succeeded in finding the net.' Unfortunately for Gloucestershire, their opponents scored another goal in the second half, and, undoubtedly, Dorset was the better team. Bristol City have been angling for Mr. Mitchell for some time past, but he prefers to face the future with the light of the Conference lamps still shining brightly on his path."

DR. A. R. FORSYTH, F.R.S., has been appointed chief professor of mathematics at the Imperial College of Science and Technology. Dr. Forsyth is of world-wide reputation, and will carry into effect the new policy framed by the governing body of the college in connection with the revision of the whole of the mathematical teaching.

We learn that MR. WILL C. MERCER, the Heckmondwike manager for Messrs. H. Hainsworth, Ltd., has been appointed chief electrical engineer at the Holbrook Colliery, Halfway, Sheffield. There were over 150 applicants.

MR. A. J. FIPPARD, of the Hankow Waterworks and Electric Light Co., Ltd., expects to arrive in England about April 21st, on a short visit.

Obituary.—SIR WM. ARROL and SIR WM. WHITE.—Within the past few days the country has lost two prominent and justly-honoured engineers, Sir Wm. Arrol and Sir Wm. White, K.C.B. Sir Wm. Arrol, the builder of the Forth Bridge, was no less an engineer for being a contractor. Without his experience and resource in overcoming the difficulties of what was then a novel method of bridge building, applied to one of the most formidable undertakings ever attempted, the work would not have been carried through so rapidly, or constructed so soundly. The sinking of the great caissons on to unequal foundations, through an unprecedented depth of water, was the first stage; and the last was the lifting from the water-level, and erection of the connecting girders—in themselves great bridges—without scaffolding, with the sole support of the vast cantilevers that had grown out boldly over the Forth, unsupported in any way, and carrying, as they grew, all the heavy tackle required in their own construction. The "vision splendid" originated in the brains of Sir John Fowler and Sir Benjamin Baker. For its materialisation, Sir Wm. Arrol was indispensable. His works live after him, and will endure so long as good material and honest workmanship can survive the attacks of nature. He was a good employer and a generous public-minded citizen. To Sir Wm. White, the eminent naval architect, must be attributed the beginning of the extraordinary progress in the size and power of battleships during the past 25 years. From the age of 14 till the year 1902, with an interval of 2 years at Messrs. Armstrong's Sir Wm. White was in the service of the Navy. Gradually working his way to the top, he was for the last 16 years of that period chief constructor. He witnessed and encouraged an immense extension of the use of electricity on war vessels, for internal lighting, for searchlights, for fire control, and for communication from ship to ship and from ship to shore by "wireless." For power purposes, such as gun-laying, ammunition hoisting, closing bulkheads, working capstans and cranes and other auxiliary machinery, a warship now calls for the highest electrotechnical skill. It is not many months since Sir Wm. White was discussing at Dundee the problem of electrical transmission for ship propulsion. He was a strenuous supporter of the leading Engineering Institutions, and engineers were looking forward keenly to his Presidency of the British Association at Birmingham this year, and to the prominence which might be expected to be given to engineering science on that occasion. After he retired from the service of the Admiralty, Sir Wm. White took a leading part in the design of the *Mauretania*. He was a great supporter of technical education, and, having carved his own way to eminence and success, was ever ready to lend a helping hand to others. His sudden seizure in his office, and subsequent death in the Westminster Hospital, have given a painful shock to his many friends and to the engineering profession generally.

MR. W. MUSGRAVE, J.P.—The death occurred on February 27th, after a brief illness, of Mr. Walter Martin Musgrave, J.P., managing director of Messrs. John Musgrave & Sons, Ltd., of Bolton, and grandson of the late Mr. John Musgrave, founder of the concern in 1839. The deceased, who was 68 years of age, had spent the whole of his life in the business, and in 1891 he succeeded his father, the late Mr. Joseph Musgrave, as head of the firm. The late Mr. Musgrave had served on the Bolton Town Council, and was a borough and county magistrate.

MR. J. G. WILSON-DICKSON.—The death is announced from Biggar, Scotland, of Mr. John Gordon Wilson-Dickson, member of the firm of Merz & McLellan, of Newcastle-on-Tyne.

NEW COMPANIES REGISTERED.

Woodbridge and District Electric Light Co., Ltd. (127,395).—This company was registered on February 25th, with a capital of £4,000 in £1 shares, to carry on the business indicated by the title, and to adopt an agreement with the Rural Districts Electric Undertakings, Ltd. The subscribers (with one share each) are:—H. T. Harrison, 11, Victoria Street, S.W., engineer; J. H. P. Berthon, 91, York Street, Westminster, engineer; S. G. Leech, 91, York Street, Westminster, engineer; G. Cornish, 51, Clovelly Road, Ealing, W., clerk; J. P. Powell, 91, York Street, Westminster, secretary; W. G. C. Masham, 54, New Broad Street, E.C., incorporated accountant; L. E. Jones, Allendale, Woodstock Avenue, Hendon, N.W., merchant. Minimum cash subscription, 500 shares. The number of directors is not to be less than two or more than seven: the first are H. T. Harrison, S. G. Leech, O. H. Valpy and W. Riggs; qualification, £100. Registered by Jones, Son and Andrews, Capel House, New Broad Street, E.C.

Mea Magneto, Ltd. (127,390).—This company was registered on February 25th, with a capital of £5,000 in 4,950 preference shares of £1 each, and 1,000 founders' shares of 1s. each, to carry on the business of manufacturers of, and dealers in, magnetos, magneto parts, and accessories, motors, motor-cars, cycles, &c. The subscribers (with one share each) are:—B. Metz, 3, Great Winchester Street, E.C., merchant; H. W. Cook, Iverdal, Billericay, confidential clerk. Private company. The number of directors is not to be less than two or more than five: the subscribers are to appoint the first. No qualification required. Registered by Goldberg, Barrett & Newall, 2-3, West Street, Finsbury Circus, E.C.

Research Laboratory, Ltd. (127,422).—This company was registered on February 26th, with a capital of £1,000 in £1 shares, to carry on the business of chemists, druggists, drysalters, electricians, engineers, suppliers of electricity for light, heat or power, &c. The subscribers (with one share each) are:—G. T. W. Olver, Foxloro, Datchet, telegraph engineer; A. Williams, 75, Rodennurst Road, Clapham Park, S.W., engineer. Private company. The first directors are not named. J. Abernethy is the first secretary. Registered office, 20, Bucklersbury, E.C.

Rubelite, Ltd. (127,478).—This company was registered on February 28th, with a capital of £500 in 1s. shares, to adopt an agreement with W. Rubel and L. W. Holmes, and to carry on the business therein referred to (undescribed in memorandum of association). The subscribers (with one share each) are:—W. Rubel, Berlin Charlottenburg Reichstr. 103, hüttenchemiker and metallurge; L. W. Holmes, 48, Great Russell Street, W.C., electrical engineer. Private company. The first directors are W. Rubel, J. Waldthausen, A. G. Temple, L. W. Holmes and H. M. Harris. Registered by Hicks, Arnold & Mozley, 35, King Street, Covent Garden, W.C.

Rebesi, Ltd. (127,391).—This company was registered on February 25th, with a capital of £1,000 in £1 shares, to purchase an option relating to type-printing telegraph systems, and to adopt an agreement with E. J. Reid and Reid Brothers, engineers, Ltd. The subscribers (with one share each) are:—E. J. Reid, 12, Wharf Road, N., engineer; M. Roberts, 197, Victoria Street, S.W., civil engineer. Private company. The number of directors is not to be less than two or more than six; the first are E. J. Reid, M. Roberts, W. B. Good and W. E. Reid; qualification £50; remuneration as fixed by the company; secretary, W. E. Reid. Registered office, 12, Wharf Road, City Road, N.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Midland Ignition Co., Ltd.—Debenture dated February 14th, 1913, to secure £600, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Capital and Counties Bank, Ltd., 23, Corporation Street, Birmingham.

South London Electric Supply Corporation, Ltd.—Issue on February 14th, of £600, and on February 18th, 1913, of £1,000 debentures, parts of a series of which particulars have already been filed.

Works Control, Ltd.—Particulars of £500 debentures, created February 6th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Indian Electric Supply and Traction Co., Ltd.—A memorandum of satisfaction in full on February 5th, 1913, of mortgage dated November 18th, 1910, securing £50,000, has been filed.

Rawlings Bros., Ltd.—Trust deed dated February 20th, 1913 (supplemental to trust deed of December 27th, 1910, securing £10,000 debenture stock, of which £5,062 is now outstanding), charged on various properties in Kensington, Chiswick, and Westminster. Trustees: J. W. Reacher, 4, Queen Victoria Street, E.C.; and W. R. Rawlings, Lakeside, Wimbledon Park, S.W.

Aluminium Stamping Co., Ltd.—Particulars of £1,500 debentures, created February 17th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

County of London Electric Supply Co., Ltd.

The directors' report for the year ended December 31st, 1912, states that the capital expended on account of the company's London districts amounted to £71,902, and the net total expenditure in respect of those districts now amounted to £1,885,648. The balance from revenue account No. II, after deducting generation and distribution costs, rents, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, was £134,082 plus £3,132 brought forward, making £137,214 available, less interest on the first and second debenture stock and interest on temporary loans to December 31st, 1912 (less income-tax), £44,039, and amount carried to reserve for depreciation, repairs, renewals, &c., £27,500, leaving for distribution for the year £65,675. Interim dividends on 55,000 6 per cent. preference shares, on 40,000 ordinary shares, and on 19,000 new ordinary shares from the due dates of calls, for the half-year ended June 30th, 1912, at the rate of 4 per cent. per annum, less income-tax, had been paid and now required confirmation. These interim dividends absorbed £23,663, and left for further distribution £42,012. The directors now recommend a further dividend on the 6 per cent. fully-paid preference shares for the last half-year, and a further dividend on ordinary shares and new ordinary shares for the half-year ended December at the rate of 8 per cent. per annum, less income-tax. These payments will absorb £36,796, and leave £5,215 to be carried forward.

The applications received during the past year amounted to the equivalent of 4,023 KW., making the total at December 31st last 45,362 KW. The total units sold were 22,512,478, as against 20,450,787 for the previous year, being an increase of 2,061,691 units. The number of consumers has increased from 18,459 to 20,246. The funds required to meet the capital expenditure incidental to the rapidly-growing business of the company have been provided by an issue in March last of 19,000 ordinary shares at par. In spite of the dislocation of business resulting from the trouble with the transport workers and the coal strike, the company maintained a full supply to all consumers. The increased costs involved have been partially met by increased economies in generation. The directors of the Bournemouth and Poole Electricity Supply Co., Ltd., have declared a final dividend on the ordinary shares of that company at the rate of 7 per cent. per annum, making 6 per cent. for the year. The business of the Coatbridge and Airdrie Electric Supply Co., Ltd., continues to show substantial improvement. The units sold during the year amounted to 4,445,035, being an increase of over 25 per cent.

Units generated	29,686,258
Units sold—Public lamps	57,524
Private consumers by meter	22,454,954
Total	22,512,478
Used on works	2,435,567
Total accounted for	24,948,045
Not accounted for	4,688,213
Public lamps	363
Total maximum supply demanded, KW.	12,800

The meeting is called for March 10th at the offices.

London United Tramways, Ltd.—The directors report a net revenue of £109,793 for 1912. After paying interest on debenture stock and loans, £41,228 remains—a decrease of £15,203, as compared with 1911. £15,000 is to be placed to general reserve, £25,000 to reserve for renewals and contingencies, and £1,228 carried forward. The meeting is called for March 12th.

Fife Tramway, Light and Power Co., Ltd.

Mr. Wm. Low, of Blebo, presided at the fourth annual general meeting, held in Edinburgh on Friday last. For the benefit of new shareholders, the chairman explained that the earnings of this company were wholly derived from dividends and fees received from the Dunfermline and District Tramways Co., the Fife Electric Power Co., and this year, to a small extent, from the earnings derived from the electric lighting companies taking power from the Fife Electric Power Co. The company owns the whole of the issued capital of the companies referred to. A sum of approximately £60,000 had been expended during the year in new capital works, against which shares were issued to this company by the two statutory companies. The earnings derived from the Tramways Co. during the year, paid over to this company as dividends and management fees, amounted to £12,200, compared with £12,600 for the year 1911. This slight fall off could be accounted for by the want of circulation of money during the coal strike last spring. The lines operated during the year were the same as during 1911, with the exception that the Lochore extension was opened on December 6th. The benefit of this extension would be felt during the current year. The Fife Electric Power Co. had made substantial progress during the year. The consumers connected in 1910 were 176; in 1911, 263; and in 1912, 381. The receipts in 1910 were £6,700; in 1911, £8,700; and in 1912, £12,200. The receipts for January were £1,880, compared with £1,260 in January, 1912. During the year transmission lines were opened northward to Frenchie, and from Wemyss towards Leven. Cables were also laid from the power station to the west and south of the Burgh of Dunfermline and from Dunfermline to Inverkeithing. During the current year, the directors proposed to largely increase the plant at the generating station to deal with the rapidly increasing demand, and to extend the transmission lines and cables to further duplicate the supply to certain areas. He moved the adoption of the report, and the declaration of a dividend on the preference shares for the half-year to December 31st, 1912, at the rate of 6 per cent. per annum, and a dividend on the ordinary shares for the year at the rate of 3 per cent. per annum.

Mr. George Balfour, in seconding the resolution, made special reference to the recommendation by the directors that a dividend of 3 per cent. should be declared on the ordinary shares. With regard to this, he pointed out that the capital expenditure during the year referred to by the chairman would be productive of a substantial increase in the revenue in the current year, and that the directors had this rapid increase in view in making the recommendation.

The report was adopted.

Capital Expansion in Germany.

The capital requirements of the German Transmarine Electricity Co. (Deutsch-Ueberseeische Elektrizitäts Ges.), notwithstanding the various large issues in recent years, have not yet been brought to a conclusion, a fresh emission of £1,250,000 in the form of 5 per cent. bonds being now in contemplation. As is known, the company possesses an extensive supply undertaking in Buenos Ayres, and is also interested in other enterprises at Santiago, Valparaiso and Monte Video. The share capital already amounts to £6,000,000, and the loans to £4,250,000, whilst the further issue of £1,250,000 will raise the total to £11,500,000. The new emission is prompted by the increase in the sale of current and the extension of the circles of consumers, particularly in Buenos Ayres, where cables are being laid in the most distant parts of the city in view of prospective competition on the part of the Lacroze Co. and the Italo-Argentine Co.

The Schuckert Electricity Co., of Nuremburg, proposes to raise fresh capital by the issue of a new 4½ per cent. loan of £750,000, and application has already been made for the admission of the loan to the Berlin Stock Exchange. Since the dividends paid on the ordinary share capital again began to assume an upward direction in 1909, the increase in the company's capital has been rapid. The ordinary shares now amount to £3,500,000, and the loan capital to £1,800,000, whilst the further emission in contemplation will raise the latter to about £2,500,000. Out of the total capital already issued the company's interests in the Siemens-Schuckert works, of which it is joint proprietor with the Siemens & Halske Co., reached the sum of £3,497,000 at the end of the financial year 1911-12. The Schuckert Co. now explains that the continued great activity of the Siemens-Schuckert works has been attended with fresh capital requirements, and the two proprietory companies intend to advance a further loan of £1,000,000 for this purpose. This transaction will raise the amount of the non-terminable loans to £3,500,000, so that with the ordinary capital of £4,500,000, and the bond capital of £4,000,000, the grand total of the capital of the Siemens-Schuckert Works will be brought up to £12,000,000. It is proposed to provide the Schuckert Co.'s share of £500,000 in the new loan to the S.S. Works out of the issue of 4½ per cent. bonds for £750,000 as already mentioned, whilst the balance will be devoted, among other matters, to the expansion of the company's Russian undertaking in conjunction with the heavy electrical engineering works of the Russian Siemens & Halske Co. It is not yet known what method will be adopted by the Berlin Siemens and Halske Co. for the provision of its half share of £500,000 in the new fixed loan of £1,000,000 to the S.S. Works.

Bruce Peebles & Co., Ltd.

In the course of his speech at the fourth annual general meeting of this company, held at Edinburgh last Friday, 28th ult., Mr. F. E. Andrews, the chairman, expressed the deep regret of the directors that the report and accounts were not of a more satisfactory nature. A year ago, they all looked forward to a successful year and anticipated with some confidence that the considerable progress that had already been achieved would not only be maintained, but would be appreciably improved upon during 1912. This had not been the case. The outstanding feature of the year had been the extraordinary number of strikes which had taken place, the evil effects of which, unfortunately for all concerned, were reflected in their trading results. The extremely difficult labour conditions which had prevailed during the whole period had sadly hampered manufacturers, and whilst gravely affecting employers, had been seriously detrimental to the best interests of the workmen themselves. In the early part of the year, whilst they were still feeling the effects of the railway strike, the strike of the coal miners took place, causing serious disorganisation of the works, for, although they had naturally provided as far as possible against the contingency by laying in a large and adequate stock of fuel, this did not help them much, as they were quite unable to obtain supplies of raw materials from other works, and even now it was impossible to get them in anything like a reasonable time. The strike also cost the company a considerable amount owing to the increase in the price of fuel, not only during the strike, but afterwards, because fuel prices were now on a much higher level than previously. Following the coal strike there was the dockers' strike in Glasgow, London, and Leith, and then in August there was a serious strike of apprentices in Scotland. They demanded an increase of wages in order to make up for the amounts which the companies were obliged to deduct in compliance with the National Insurance Act. This Act was another burden on industry, and it was difficult to see what recompense, either direct or indirect, manufacturers could possibly derive therefrom, unless it proved true, as he thought it would, that the passing of the National Insurance Act was the tolling of the knell of Trade Unions. Shortly after the apprentices' strike they had two strikes of the carters at Leith, which again impeded them by still further delaying delivery of raw materials, and finally towards the end of the year a strike of electrical winders took place, and this had only recently been settled. All these strikes had the effect not only of increasing the expenses of the year, but they seriously interfered with the output of the works, which might have been much greater but for these troubles. Thus 1912 had been a distinctly worrying and trying period, during the whole of which they had been anxiously contending with seriously adverse labour conditions—conditions largely brought about by present-day politicians, whose chief aim seemed to be to pass pernicious and ill-considered legislation, which only hampered the masters and irritated the men, and was therefore bound, sooner or later, to cause disagreement. Then, when disputes arose, the Government stepped in and patched up a so-called peace, which was unsatisfactory to all concerned. In his opinion, the ultimate effect of Government interference in industrial disputes was disastrous. All these strikes naturally caused a steady rise in the item of labour on all contracts they had in hand; but, apart from this, there had been a considerable increase in the cost of all raw materials, so that when one considered the very low prices it had been possible to obtain for electrical machinery, it was not difficult to account, to a large extent, for the poor results of the year's working. But although these results were disappointing to all, especially to those on his side of the table, representing as they did such a large proportion of the total capital of the company, they would be glad to hear that in some directions they had continued to make a steady and substantial progress. The total value of orders obtained had been greater than at any time during the existence of the present company, and they were now approaching the maximum capacity of their existing workshops. The volume of work given out in the home markets had undoubtedly been greater than for a long time past, and they had been successful in obtaining a fair share, but it was unfortunately the fact that prices had not until quite recently improved to any appreciable extent, and they showed an inadequate margin over the bare cost of materials and wages. Orders also were still often placed under conditions which entailed giving unreasonably long credit for a considerable portion of the contract sum and on terms which were unfair to the manufacturer. In this connection, however, some improvement had been brought about by the British Electrical Manufacturers' Association—their efforts, under the able chairmanship of Mr. Bruce Anderson, were already bearing fruit, and he could only express the hope that their admirable work in the interests of the industry would be vigorously continued. They themselves had, in a slight degree, as the works got full, been able to discriminate to some extent in the contracts they had accepted, but on account of unreasonable terms and conditions they had had to allow some business to go past them, and had had also to decline more than one substantial order, because they felt it was impossible to obtain the raw materials in time to enable them to deliver by the date required, and they were not disposed to jeopardise their reputation for good deliveries and run the risk of incurring penalties for being late. However, they had not very much ground of complaint regarding the amount of work which had been entrusted to them, and he was not without hope that the present tendency of prices to harden slightly would continue and the general position be thereby somewhat improved. With regard to foreign business, they had continued their active campaign abroad, and in pursuance of this policy sent one of their engineers on a five months' tour in South America, during which time he visited their agencies in Brazil, Argentine and Chile. The results of his journey were quite satisfactory, and he had no doubt, as time went on, they would be recompensed by increased business from those countries, in the same way as they had reaped improving results from other parts of the world which had been similarly visited by their engineers on previous occasions. Electrical engineering was a science that progressed at a great rate, and machinery that was judged splendid three or four years ago, was only considered very passable to-day. Hence it was essential for manufacturers who intended to keep in the front rank to be continually overhauling and improving their designs. The machinery that they turned out continued to give every satisfaction, and it was an eminently gratifying feature that the number of customers on the books was constantly and steadily increasing. In the accounts, buildings, machinery and plant stood at the same figure as before. Of course, it would be very desirable to write off a certain amount for depreciation, but this was obviously not feasible until the profits were sufficient. All additions to loose plant and tools were debited against the results of each year, and everything was kept in a very high state of efficiency, a considerable sum being spent each year in so doing—this year no less than £4,138. This amount was, of course, appropriated from the revenue before arriving at the figures in the profit and loss account. Fuel cost £1,604 more than in the previous year, and the Workmen's Compensation Act tended to become an ever-increasing burden, for whereas when the Bill was under discussion it was stated that the cost to the employer would not be more than 1s. 6d. on each £100 of wages paid, the average was now something like 25s. per £100, and very possibly it might go still higher. Stock, stores and work in progress stood at £52,282 this year, as against £36,481 before, which was an indication of the increased volume of work in hand at the end of the year. The orders in hand at the present time were sufficient to keep the works going at their full capacity for some time. Debts due to the company stood at £48,686, whilst the debts owing by them amounted to £30,517, showing a balance in the company's favour of over £18,000, whilst the actual cash in hand was over £10,000, so that their position in this respect was quite satisfactory. The profit of £3,865 from the manufacturing and trading account was, unfortunately, smaller this year than last, so that after paying the interest, amounting to £3,452, on the mortgage debentures, and allowing for the interest of £3,987 accrued on the unsecured debentures, there was an adverse balance on the year's working. This shortage, however, was more apparent than real, and did not affect their cash position to any appreciable extent. The net result of the year was that, after paying all expenses and spending £4,138 on the efficient maintenance of their plant, they had a surplus nearly sufficient to cover their mortgage debenture interest. Since the formation of the company, each year up to the present had shown substantial progress. What was now wanted was a period of immunity from these incessant labour troubles, so that employers and employed could proceed steadily with their legitimate work. Though disappointed, he, personally, was neither discouraged nor disheartened; the outlook was distinctly brighter, and he had reason to think that when they met next year they would be able to look back on 1913 with much more pleasurable feelings than they did on 1912.

The report was adopted.

Aberdeen Suburban Tramways Co.—At the half-yearly meeting Mr. A. Wilkie, managing director, in moving the adoption of the report, said that the directors had been considering the extension of the tramway system both on Deeside and Donside, and had had under consideration various systems, both trackless trolley-cars and motor-'buses. The leading factor which the directors had to keep in view was the cost of power. They would have to get their electrical supply at a more reasonable price. Motor-'buses had greatly improved lately, but if they could get their electricity at a slightly reduced cost they might favour the trackless trolley system. They were just now waiting for a reply from the Corporation with regard to the price they were going to charge for the electricity. No doubt that would have a great deal to do with the decision which the directors might submit to the shareholders at a future meeting. The reports were adopted.

Metropolitan Electric Supply Co., Ltd.—The directors announce a dividend for the last half-year of 1912 at the rate of 4½ per cent. per annum, making 4½ per cent. for the year, as against 4 per cent. in 1911, placing £20,000 to reserve, as against £17,000.

Brompton and Kensington Electricity Supply Co., Ltd.—The *Times* states that, after appropriating to depreciation and sundry reserve accounts £14,200, the directors recommend the payment of a final dividend on the ordinary shares for the half-year ended December 31st at the rate of 11 per cent. per annum, making 10 per cent. for the year, carrying forward £7,001.

Willans & Robinson, Ltd.—A petition for confirming the reduction of the capital from £483,336 to £141,665 is to be heard in London on April 4th. An announcement on the matter appears in our advertisement pages to-day.

California Railway and Power Co.—The directors have declared an initial dividend of 1¾ per cent., or at the rate of 7 per cent. per annum, on the prior preference stock.

Ottawa Electric Railway Co.—A dividend of 12 per cent., with a bonus of 3 per cent. for the past year, is announced in a financial daily.

Metalite, Ltd.

THE adjourned second annual general meeting was held on Friday, at 20-22, Christopher Street, Finsbury, E.C., Mr. W. Stewart, the chairman, presiding.

The CHAIRMAN, in proposing a resolution for the further adjournment of the meeting until April 29th, when the audit of the accounts would be completed, said that the bank, on the 6th inst., appointed a Receiver of the company's property to secure an advance which they had made. In the meantime, the directors were not letting the grass grow under their feet, and arrangements were practically complete for placing at the company's disposal a minimum of £12,500 within a period of two months. Under the contemplated arrangement, the board would be strengthened by the appointment of additional directors, which, he thought, could only be for the benefit of the company and the shareholders. He would give them full details at the next meeting, and, in the meantime, he was glad to be able to tell them that the series of debenture-holders, in order to assist the company, had agreed to postpone their security, so that there did not appear to be any likelihood of the matter falling through. The £25,000 series of debentures were held almost exclusively by the directors and their friends. He was satisfied that under the proposed arrangement, the company would have an excellent opportunity afforded it of doing a profitable business. The whole details would be placed before the shareholders at the adjourned meeting.

A shareholder said he would like to ask whether the directors and the secretary had retired.

The CHAIRMAN: Neither the directors nor the secretary have retired.

The shareholder said he would like to know whether the new lamp was being manufactured, and whether it belonged to the company. Further, he wished to know whether there was any litigation pending against the company or the directors. He remembered that at the meeting at Derby there were threats of litigation, and he would like to know whether they were still pending, or, if they had been settled, in what manner. He further inquired whether the works at Derby were still open, and whether the new lamp was to be had anywhere.

Another shareholder asked whether the adjourned meeting would be held in Derby or London.

The CHAIRMAN, in reply, said that the next meeting would be held in London. The directors were still in office. Mr. Metcalfe was unwell and unable to be present, but Mr. Bentley was present. Mr. Alderton had retired. The new lamp did belong to the company. So far as he knew no litigation of any sort was at present in existence against the company or the directors.

The SHAREHOLDER: That does not answer my question about the litigation that was threatened at Derby.

The CHAIRMAN: You refer to the petition; a petition was presented, and it was dismissed.

The SHAREHOLDER: I am not referring to the winding-up of the company. There were threats at Derby about action being taken against the company or the directors.

The CHAIRMAN: We know nothing of them. A Receiver was put in on the 6th of this month. There are a few lamps in stock, but there are none being manufactured at the present moment.

In reply to another shareholder, the CHAIRMAN said they were paying £400 a year for the rent of the premises in which they were meeting, and it was the intention of the board to sublet some portion of it.

The resolution was then carried, and the meeting stood adjourned until April 29th.

North Metropolitan Electrical Power Distribution Co., Ltd.

THE report submitted to the meeting held at Kingsway, W.C., on March 4th, stated that the revenue amounted to £17,846, an increase of £2,040 compared with the previous year. The balances from the local revenue accounts amount to £6,859. After adding sundry receipts and £214 brought forward, and deducting administration expenses, legal charges and debenture interest, there remains £5,291. The directors propose that £1,000 be put to renewals, £1,000 to reserve, and that 6 per cent. be paid on the ordinary shares, requiring £3,000, leaving £291 to be carried forward. The expenditure upon capital account during the year amounted to £2,973, of which £2,373 was in respect of extensions of mains and installations upon consumers' premises.

Barnet Electric Supply.—The revenue amounted to £5,639, compared with £5,637 during1911. Installations connected to mains approximately equivalent to 22,100 30-watt lamps.

Enfield Electric Supply.—The revenue for the year amounted to £3,821, compared with £3,056 during 1911. Installations connected to mains approximately equivalent to 18,950 30-watt lamps.

Hertford Electric Supply.—The revenue amounted to £3,820, compared with £3,787 during 1911. Installations connected to mains approximately equivalent to 19,950 30-watt lamps.

St. Albans Electric Supply.—The revenue amounted to £4,334, compared with £3,148 during 1911. Installations connected to mains approximately equivalent to 29,450 30-watt lamps.

The additional connections made during the year to the mains in the four districts represented the equivalent of 12,150 30-watt lamps, making a total connection at the end of the year of approximately 90,450 30-watt lamps. The number of units sold during the year was 1,337.157, which, compared with the previous year's figure of 1,159,323, was an increase of approximately 15 per cent.

Application is being made for an electric lighting provisional order for the Urban District of Wood Green, and for an extension of the Barnet order, to include the parish of Arkley. The Wembley Electric Lighting Order, 1906, which was granted to the Wembley Urban District Council and transferred to the company, has been re-transferred back to the Council under Sec. 67 (*b*) of the Electric Lighting (Clauses) Act, 1899, for a nominal consideration.

	Barnet.	Enfield.	Hertford.	St. Albans.	Total.
Units purchased ..	577,330	264,400	261,685	371,980	1,475,345
Units sold—Public lamps	50,124	—	7,262	—	57,386
By contract	319,414	56,614	71,777	179,932	627,737
Private consumers by meter	136,486	187,411	158,945	169,192	652,034
Total sold	506,024	244,025	237,984	349,124	1,337,157
Not accounted for ..	71,306	20,375	23,651	22,856	138,188
Public lamps	201	—	31	—	232
Max. supply demanded	310 KW.	188 KW.	158 KW.	257 KW.	—

Bournemouth and Poole Electricity Supply Co., Ltd.

THE directors' report for the year ended December, 1912, says that capital expended during the year amounted to £9,371, making the total £469,577. The balance from revenue account, after deducting generation and distribution costs, rent, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries is £37,606 plus £1,209 brought forward, making £38,816. From this there are deducted interested on debenture stock and interest on temporary loans, less income-tax, £9,145; leasehold and special redemption funds and interest, £1,762; amount written off suspense accounts, £637; amount carried to reserve for depreciation, &c., £5,000; leaving available for distribution, £22,272. Interim dividends on the 7,500 4½ per cent. preference shares, on the 15,000 6 per cent. second preference shares, and on the 15,000 ordinary shares at the rate of 5 per cent. per annum for the half-year ended June 30th, 1912, less income-tax, amounting to £9,358, have been paid, leaving for further distribution £12,914. Final dividends on the 4½ per cent. preference and on the 6 per cent. second preference shares for the half-year ended December, less income-tax, have also been paid.

The directors recommend a final dividend on the 15,000 ordinary shares, at the rate of 7 per cent. per annum, for the half-year ended December, 1912, less income-tax. The above final dividends absorb £10,770, leaving £2,144 to be carried forward.

The total applications received at December 31st last amounted to the equivalent of 8,245 KW., being an increase of 613 KW. for the year. The total units sold for all purposes was 3,338,425. The directors of the Richmond (Surrey) Electric Light and Power Co., Ltd., have declared a dividend of 6 per cent. on the ordinary shares for 1912. Mr. H. B. Renwick, previously secretary, has been elected to the board, and appointed managing director. Mr. W. D. Brightman, previously local secretary, has been appointed secretary to the company; and Mr. F. C. McQuown has been appointed London secretary.

Units generated	4,022,129
Units sold—Public lamps	22,795
Private consumers by meter	3,315,630
Total	3,338,425
Used on works	363,014
Total accounted for	3,701,439
Not accounted for	320,690
Public lamps	190
Maximum supply demanded, KW.	2,347

The annual meeting will be held in London on March 13th.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Consolidated Cities Light, Power and Traction Co.—$4,000,000 first lien 5 per cent. gold bonds, in lieu of the scrip.

La Plata Electric Tramways Co., Ltd.—£100,000 5 per cent. first mortgage debenture stock (special application).

Western Canada Power Co., Ltd.—£205,400 5 per cent. 40-year first mortgage bonds of £100 each (Nos. B 1 to 2,054) (renewed application).

Davis & Timmins, Ltd.—The directors report that the net profit for the year ended December, 1912, including £10,452 brought forward, after allowing for depreciation and commission to manager, was £29,270. After paying interim dividend on the 6 per cent. preference shares and interim dividend at the rate of 6 per cent. on the ordinary, there was placed to general reserve account £2,000, leaving £24,060. The remaining dividend on the preference shares requires £1,800, and a balance dividend at the rate of 10 per cent. per annum on the ordinary shares for the last half-year is proposed, making 8 per cent. per annum for the year (requiring £2,350), also a bonus of 10 per cent. out of profits (£4,700), leaving to be carried forward £15,210. The annual meeting is called for March 14th.

British Insulated and Helsby Cables, Ltd.—The directors recommend a final dividend of 6s. per share, making, with the interim dividend already paid, 10 per cent. for the year. £90,000 is to be placed to reserve and depreciation, leaving about £74,000 to carry forward.

Continental.—SWITZERLAND.—La Société Suisse pour l'Industrie Electrique, of Basle, is declaring a dividend of 7 per cent. for the last financial year, the same as for the preceding 12 months.

South Metropolitan Electric Light and Power Co., Ltd.

MR. H. ST. JOHN WINKWORTH presided on February 26th at Winchester House, E.C., over the annual general meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, p. 314), the CHAIRMAN said that it was the most favourable report for some years past. The number of consumers increased during the year by 566, which compared with 392 for the previous year, and constituted a record. In addition, 552 extension orders were received from existing consumers, an increase of 30 per cent., making a total of 1,202 new and extension orders for the year. The 35-watt lamp equivalents also showed a record increase of 28,681. The total units sold were 5,481,346, as compared with 4,855,580—an increase of 12·8 per cent. The sales of electricity produced £52,489, as compared with £47,636—an increase of £4,853, or 10·2 per cent. The revenue for 1911 included about £2,000 for electricity supplied to the Festival of Empire at the Crystal Palace, and as there was no such item in 1912, the growth of the general business was in reality larger by that sum. Coal cost £1,560 more, about £1,000 of which was extra cost caused by the colliers' and lightermen's strike in the spring and summer, as the directors felt it necessary to increase the stock of coal and to take all steps possible to ensure a continuous and unrestricted supply of electricity for all classes of consumers. The stock was reduced during the strikes, but had since been built up again, and they now had stored on vacant land about three months' supply of coal. The development expenses were a little less, notwithstanding a large increase in the outdoor staff, owing to the continuous increase in the business done at the showrooms, the number of transactions having increased from 2,750 for 1911 to 4,080 for last year, and the sales exceeded £10,000. The company's offices and showrooms in High Street, Lewisham, had proved most useful as a supplement to the work of the outdoor representatives. The total expenditure he had dealt with amounted to £22,670, or £2,129 greater than last year and represented 40 per cent. of the gross receipts, as against 39·8 per cent. The cost per unit sold amounted to ·99d. as compared with 1·01d. They had a net revenue of £33,933, an increase of £2,861, which represented a return of 5·8 per cent. on the average capital expenditure as compared with 5·49 per cent. for 1911 and 4·91 per cent. for 1910. In the course of his references to the capital account, the chairman said that about £5,000 was in respect of the new 1,500-KW. turbine, which was expected to be brought into service shortly, and in addition to enabling the company to cope with a large increase of business, considerable economies in working should be effected. The business of the West Kent Electric Co. was developing, and the accounts for the past year showed a small profit after providing for all expenses. During the year agreements had been entered into with the Woolwich Corporation and the Urban District Council of Bexley for bulk supply, and arrangements were being made for affording a supply in other districts. Looking to the future, their prospects were distinctly favourable. The large increase in the connections last year would benefit the revenue for the present year. The new orders received this year were greater, and the connections made compared favourably with the corresponding period of 1912, while as regarded power, the factories, more particularly in the industrial area, were busy with contracts, and extension orders were being negotiated. The output of units sold showed a satisfactory increase, so that their gross receipts for the current year were likely to show a marked increase. On the other hand, they had to face a higher price for coal, but they expected to be able to effect economies by a greater use of the most economical plant, so that he hoped when they met again next year they would be able to present accounts which would show further and substantial progress.

MR. H. BOWDEN (managing director and engineer), in seconding the motion, said that last year he referred to the important developments taking place in the Lewisham area. The demand had still further increased and was being largely dealt with by the extra high-tension system, which continued to work efficiently and satisfactorily. The area was now practically covered by the high-tension network (except Brockley, where further extensions were anticipated). Having regard to the extensive area covered by their network of cables, they had for the year under review, been remarkably free from faults or interruptions of any kind, and this might perhaps be attributed to the systematic testing and frequent inspection which was pursued of all cables and apparatus, thus permitting the removal of incipient faults before they became troublesome. As a result, the cost of repairs was extremely small. The maximum load had increased from 3,600 to 4,000, or 11 per cent. The output on feeders at the power-house had increased from 6·3 millions to 7·06 millions units, or 12 per cent. The units sold advanced from 4·85 millions to 5·48 millions, or 12¾ per cent. From these figures it could be seen that the efficiency of distribution had increased from 77 per cent. to 77·6 per cent. At the power house they had laid down one 1,500-KW. turbine and two boilers, which were practically finished and ready for steaming. He had hoped to be in a position to tell them the new set had been started, but, owing to the delay in the delivery of material, this had not been possible. The plant should, however, be available within a fortnight. The total cost per unit had been reduced from 1·01d. to ·99d., but a still further saving would have been shown had it not been for the coal, which had increased from ·35d. to ·37d. This increase was largely accounted for by difficulties experienced during the strike (although he was glad to say they were able to give an uninterrupted supply without exhausting their coal stock), and by the inferior quality of the coal delivered about this time, and partly owing to the late delivery of new plant, which they had hoped would have been in time to assist the winter load, and thus largely dispense with the almost constant running of the reciprocating plant in the West House. He thought they might look to see considerable economies effected in this direction, except for any increase they might be obliged to pay on entering into a new coal contract. It was satisfactory to note that their total cost per unit had been reduced, and he thought he was correct in saying that they still held the second lowest total cost for all the London companies.

MR. POWELL said it seemed to him the position of the ordinary shareholders was hopeless, and it did not seem that the expenditure incurred had been justified by the results. The West Kent shares were put in the balance-sheet at par, and he did not know how far the directors were justified in doing that. Instead of carrying forward £5,000, they ought to wipe out the preliminary expenses.

MR. HUGHES also expressed disappointment, and said he had been requested by Liverpool shareholders to ask what fees the managing director got, and what time he devoted to the company.

MR. HIBBERT thought the board might have paid 2½ per cent. this year, as that would have helped them to place debentures and preference shares.

The CHAIRMAN said that the board, who were large shareholders, regretted the non-payment of a dividend, but they felt it was in the true interests of the undertaking to conserve their resources at the present time, and build up a strong financial position. As he had previously explained, by the terms of the debenture trust deed they were prohibited from paying a dividend until they put away to reserve and depreciation a sum equivalent to 2½ per cent. of the capital expenditure during the year, and therefore the profits were not sufficient for the payment of a dividend. He certainly thought the shareholders were within sight of a dividend. The managing director received the same fees as a director as the other directors did, and he received £600 a year as managing director and engineer-in-chief, and he spent a great deal of time in the service of the company.

The report was then adopted, and a vote of thanks was accorded to the staff.

Bath Electric Tramways, Ltd.

THE annual meeting was held on Thursday last week at Winchester House, E.C., the Hon. Sir James Sivewright, K.C.M.G., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., p. 357), said that although they had undoubtedly earned, they did not find themselves in a position to pay, a dividend on the preferred ordinary shares. The cause of that was the same as he dwelt on at considerable length last year. Naturally there was a feeling of irritation on the part of the preferred ordinary shareholders, and on nobody's part was that irritation more felt than on his own, because he was far and away the largest preferred ordinary shareholder. He had held 10,000 of those shares since the inception of the company, which he subscribed for at par, and he had not parted with a single one. It would, therefore be understood that they had done everything in their power to meet the situation, and be in a position to pay the dividend which they had earned. One or two shareholders had written complaining of the report, including the secretary of the River Plate Electricity Co., which company held 2,700 preferred ordinary shares. In the course of his letter he said that the report was most unsatisfactory, and he said that the phrase which the directors used as to the pending completion of arrangements which were being made for meeting the loan standing in the balance-sheet at £21,150, had been used over and over again. That was not quite the fact, but he could say that to-day they were at all events nearer the completion of the necessary finance to enable them to attain the end in view. Having referred to the history of the negotiations and their present position, he said that if they succeeded, they would have a sufficient sum of money to repay the loan to the bank, and it would also give them money for improvements which would bring in a fair return. The secretary of the River Plate Co. went on to criticise the action of the directors in putting aside £8,000 to the contingencies and renewals account, which he regarded as altogether unnecessary and unjustifiable. In view of the fact, to which the auditors drew attention, that no special provision had been made for depreciation, the directors were rather in the position of being between the devil and the deep sea in that respect. All he could say was that they believed the policy which they were carrying out was a conservative one. They had maintained the system in all its branches—tramways, motors and foundry—in a manner second to no similar undertaking in the kingdom. They had paid off £5,000 of their debentures; they were carrying forward £3,200, and they had put to the renewal and contingencies account £10,000, making in all about £18,000, which was available. Not only had they done that, but they had just ordered, and partly paid for, four new torpedo motor-omnibuses. The traffic receipts showed an increase of £2,163 over those of the previous year—in fact it was the best year that the company had ever had. He was sorry to say, however, that the net profits were considerably less, owing to a variety of causes. They had to pay a very largely increased price for coal, but although the price had gone up since the strike, their coal bill for 1913 would be considerably less than it was last year. That was due to the introduction, also paid for out of revenue, of mechanical stokers which would enable them to burn a much inferior class of coal. The motor-omnibus traffic was very satisfactory and was full of promise. They had gone very carefully into the cost of running the system, and he thought they could hold their heads up against any tramways either company-owned or belonging to municipalities.

Their working expenses per mile last year were 5'005d., which was considerably more than in 1911, owing to the causes he had referred to. In the case of 17 companies whose records were accessible their average cost of working in 1911 was 5'980d. per mile, and in the case of 79 local bodies possessing tramways the average cost per mile was 6'56d. He thought, therefore, they might fairly claim that in their staff they had an efficient, vigilant and economical body of men. As to the future, it was very dangerous to prophesy, but the first eight weeks of the present year had shown an increase in gross receipts of £300, and an increased net profit of a little over £100. Given a fairly average summer and a fair autumn, they would see a very considerable increase both in the gross takings and in the net profits. Should that be so, and should they succeed in carrying out the financial arrangements to pay off the bank loan, then he thought he could positively promise that the long-deferred goal of paying a dividend on the preferred ordinary shares would be reached.

Mr. Hugh Clutterbuck seconded the motion, which was adopted after a short discussion.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

Col. R. E. Crompton, C.B., presided on February 27th, at the offices, 148, Brompton Road, S.W., over the meeting of this company.

In moving the adoption of the report (see Electrical Review, page 313), the Chairman first referred to the absence of Mr. Erskine, their secretary, who had been with them during the whole of the life of the company and was away for the first time, but he was glad to say that after a prolonged illness he was now in a fair way of recovery. It was proposed to pay the same dividend as last year, and the carry forward was increased from £1,680 to £1,780. The total amount now standing to the credit of the renewal and reserve fund, £115,361, was very substantial and satisfactory. There were two chief causes for the diminution of the profits earned during the year, the first being a falling off in revenue due to the reduced sales of current from £76,918 to £75,847, a decrease of £1,071, or about 1'4 per cent. The other cause was the increased price of coal, which was likely to be intensified in the future. They had not had to pay an increased price for coal itself, which was a direct result of the coal strike, but in addition they had had to deal with an indirect result of the strike, as they had to draw very largely on their reserved stock which had accumulated at Wood Lane, and which had, to some extent, deteriorated by exposure, so that an extra quantity of this reserve coal had to be used to generate a given quantity of electricity. During last year the price of coal per ton increased by about 10 per cent. The combined effect of this increase in price, and the increased quantity used from the reserved stock, had increased the total working cost per unit supplied from the Wood Lane works to Kensington customers by about 11½ per cent., and it seemed from the still higher price they had to pay for coal for the coming year, averaging the existing contracts, and the new contracts they had yet to make, they must be prepared for a future increase in the cost per unit delivered, of about 15 per cent., and this would affect the total supplied to their customers by about 5 per cent. Under these altered conditions of cost of production, the directors had under anxious consideration the best method of meeting it. The falling off in the units sold was not large, and the fall which actually showed was due partly to the Early Closing Act, which affected the units sold to shops and other trade customers, and the board found it would be necessary to adjust the price to those customers to meet the altered conditions. As the shareholders were aware, the price per unit realised by them for the sale of electricity was especially low for the district, and they compared favourably in point of cheapness with any other company or district. They could not expect any considerable increase in the output otherwise than by the rebuilding going on in certain neighbourhoods where small houses were being pulled down and replaced by larger ones, and there was no doubt whatever that the increased cost of manufacture must be met by some adjustment of their price. In view of the liberal discounts they had been giving in the past, they thought this could be done without any of their customers feeling it. Apart from the increased cost of coal, the general cost of distribution and administration including that of maintaining their plant and mains and meters in as perfect a condition as possible, had not increased, in spite of the fact that they had had to make good during the current year the result of the short-circuit of mains, which occurred shortly before he addressed them at the last meeting, and when he put before them the possibility that they would have to pay heavily for that trouble. He thought the shareholders were to be congratulated that they had practically paid for that short-circuit without any notable increase in their maintenance cost.

Mr. R. Wallace, K.C., seconded the motion.

Mr. Killingworth Hedges said that it was with a little feeling of disappointment that he heard the chairman foreshadow that the output of electricity would not be increasing, but that it might from certain circumstances tend to decrease, and it behoved this company, as well as other companies, to do all they could to popularise electricity. The speaker referred to efforts which were being made to establish electric cooking, and personally spoke highly of such cookery, but said he found electric lighting companies gave away plenty of literature about cookers and heaters, but did not give the public facilities for seeing how these things were done. He thought they ought to follow more on the lines of the gas companies when they introduced gas cookers.

The Chairman said they had co-operated with other companies and with the local authorities, and had done a good deal to popularise electric cooking and heating. No one was a greater believer in the future of these two methods of utilising electric energy in residential districts than himself, but it was a slow process to overcome the conservatism of the English kitchen. He thought it highly probable that in six or seven years' time they would have made considerable progress in electric cooking, but he hardly thought it wise, at a shareholders' meeting, to put before them that there was likely to be any substantial increase in the output of electricity during the next year from this cause, although they were doing all they reasonably could to further what Mr. Hedges asked. Owing to the care observed by the staff the cost of the short-circuit they experienced was not one-twentieth of what they anticipated it would be at first.

The report was then adopted, and a hearty vote of thanks was accorded the board, Mr. Miller, the engineer, and the staff for their services, on the motion of Mr. Hedges, seconded by Mr. Schwann.

Telegraph Construction and Maintenance Co., Ltd.

The meeting of this company was held on Thursday last week at the offices, 38, Old Broad Street, E.C., under the presidency of Lord Selborne.

The Chairman, in moving the adoption of the report (see Electrical Review, page 311), said that the net profits for the year had amounted to £109,000, as compared with £87,000 in the previous 12 months. Adding £106,000 brought forward, they had a total of £216,000, as against £195,000 last year. From that had to be deducted the interim dividend already paid of £22,000, which left £193,000 available for distribution, as against £172,000 a year ago. The directors proposed that the reserve fund should be increased by the addition of £20,000, as against £10,000 last year. They proposed a dividend at the rate of 10 per cent. and a bonus of 12s. per share, which would leave practically the same amount to be carried forward as was brought into the account—£106,000. The freehold and leasehold premises, machinery, plant, stocks of stores and materials, stood at nearly £619,000, a considerable increase over last year, the reason being that they had larger stocks of materials on hand, and a larger amount of manufactured cable in connection with contracts in progress. On the other side, the debts owing by the company, and reserves for insurance and contingencies (£1,407,416) had increased. The conservative policy which the board had always adopted in dealing with the company's finances had hitherto met with the approval of the shareholders, and he could give them an illustration to show how necessary that policy was for the success of the company. The amount of material used in the business in the course of a year was very large indeed—partly raw material and partly manufactured material, which they further manufactured, such as gutta-percha, jute, copper, iron, and, of course, a very large amount of coal. As they dealt in such large quantities, it was of the greatest importance that they should buy their materials at the most favourable moments, and one of the secrets of their success was that they were able to do that by reason of the financial strength of the company. At the moment, they had important contracts in connection with work in the Far East. Last year was a period of comparatively small jobs, largely on behalf of foreign Governments, and those Governments, he was glad to say, had always testified their great satisfaction as to the way in which work had been done for them. As he had said they had undertaken an important and anxious work in the Far East. It was in the interests of the company that they should be able to take such contracts, although the responsibility connected with them involved great anxiety, but they could not undertake such work unless they had large stores of materials. Then, again, last year had been a period of great unrest with the railway strike, the coal strike, and the dock strike. Each one of these strikes might have affected their business very seriously, although the relations between the management and the workmen had always been of the most harmonious and sympathetic kind. Their work was not impeded for a moment in spite of those troubles, because they had large stocks of material on hand, and he might say that when the coal strike ended they had enough coal in stock to carry on the works for two months longer.

Sir James Pender, Bart., seconded the motion.

Replying to a shareholder, the Chairman said his opinion was that wireless telegraphy would always have a market of its own, and he did not think it would seriously interfere with work which could only be done by the cable.

The report was adopted.

Chelsea Electricity Supply Co., Ltd.

The directors' report for the year ended December 31st, 1912, states that the profit for the year amounted to £37,460, which, with £3,241 brought forward, and £1,937 for interest, makes a total of £42,638. After deducting interest on debenture stock, £7,875; interim dividend on the preference shares at the rate of 6 per cent. per annum, £900; interim dividend on the ordinary shares at the rate of 4 per cent. per annum, £4,944; there remains a balance of £28,919, which the directors recommend shall be appropriated as follows: to credit of reserve for renewals, depreciation and contingencies, £13,626; to credit of debenture stock premium redemption fund, £704; to amount written off cost of extinction of founders' shares, £1,089; to amount written off cost of purchase of Cadogan Electric Light Co., £1,000; to amount written off cost of invest-

ments, £1,352; to final dividend on the preference shares at the rate of 6 per cent. per annum, making 6 per cent. for the year, £900; to final dividend on the ordinary shares at the rate of 6 per cent. per annum, making 5 per cent. for the year, £7,415, leaving to be carried forward £2,833. The number of 8 C.P. lamp equivalents connected on December 31st, 1912, was 293,973, an addition of 11,597 during the year, and the total number of units sold was 4,184,072, being 167,594 more than for the previous year. The directors record the death of their late colleague and chairman, Sir Irving Courtenay. The vacancy on the board has been filled by Mr. Stanley Beeton. Mr. W. R. Davies has been appointed chairman.

The meeting is called for March 12th.

British Electric Transformer Co., Ltd.

THE annual meeting was held on February 28th at Salisbury House, E.C., when, in the absence of Mr. J. F. Albright (the chairman), through illness, Mr. A. F. Berry presided.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 359), first dealt with the variation of the figures in the balance-sheet, due to the increase in the capital owing to the acquisition of the whole of the Berry Construction Co. in accordance with the agreement of April 1st, 1912. Sundry creditors were more by about £1,767, due to increased business and its extending nature. They did not propose to add anything to depreciation reserve, as their advisers did not consider it necessary. On the other side of the balance-sheet, the item for patents and goodwill had been increased by £26,632, due principally to the absorption of the Berry Construction Co., as owners of the "Tricity" cookers and heaters. They had the general reserve account of £21,745, which could be set against this asset or for any contingency. The goodwill alone of a business such as theirs, which was the result of something over 15 years' continuous specialisation, and one which earned them profits of about £20,000 a year, if valued in one or other of the many different ways of arriving at a fair valuation, would give them a sum of about £60,000, but in addition to this, there was the value of the patents. It was, of course, on these patents that the business and the goodwill had been built up. Some of their foreign patents had been sold, and for others licences had been granted, and they were now earning a revenue. The cost of all lapsed patents or those sold had been written off, and the patents left, numbering well over 100, and being regularly added to, were the only ones included in the balance-sheet. Having dealt with the items of freehold land and buildings, &c., and of office furniture, the chairman said the increase of £10,600 in the stock was incidental to a business such as theirs, where with increased orders they had to carry increased stocks of raw material. The manager's valuation of the stock had been verified as far as possible by the auditors, who were of opinion that the valuation was on the conservative side. Work in progress accounted for a large part of the item of stock and materials, and was taken from their cost books, which were very carefully kept, and were also verified by the auditors. Investments were increased owing to the investment of some of their spare cash. All the business of the year had been done on a strictly cash basis, and there were no shares taken in part payment, or anything of that sort. With regard to the profit and loss account, general charges were increased by about £3,786 in consequence of the largely-increased amount of work they had done in both the transformer manufacture and the "Tricity" cooker manufacture. The gross profit was about £4,874 more than last year and discounts, &c., were £892 in excess. Turning to the year generally, 1912 had been quite eventful for the company in several ways. About this time last year, they had to face the consequences of the coal strike, difficulties in getting raw materials, and in delivering their finished goods. But in spite of all the difficulties they had in common with most other manufacturers of electrical apparatus throughout the country, shared in what was clearly a trade boom, in the electrical world at any rate, and the volume of work turned out was considerably in excess of that of 1911. Their shipping work increased appreciably, and in nearly every case where they had obtained an order from abroad they had got repeat orders, which was perhaps the best testimony they could ever hope for. They commenced the year 1913 with some 25 per cent. more work than they started 1912, which, as they were told last years was a record and far in excess of anything they had previously done. It was not safe to prophesy, but they did not see any reason why there should be any falling off in the orders, judging by the number of inquiries they received. This year they started with practically the same loyal staff, and there seemed no reason why the operations of the company should not proceed just as smoothly as in the past. With regard to the manufacture of transformers, in the past they had been used more particularly by authorities supplying electric light and power and dealing only with alternating current. But owing to the increase in the demand for electrical energy, and the greater distance over which it had to be distributed, the direct-current stations and the railway companies had found it necessary in a number of instances to put down alternating-current plant for the generation and transmission of electric energy, and by means of transformers and rotary converters to convert the direct current just where the energy was required. The principal purchasers of transformers to-day were Corporations, Government departments, railway, tramway, colliery, mining, electric light and power companies—all of which they would agree were a first-rate class of customers to get on their books. The "Tricity" business was progressive, and the users of their cooker expressed themselves well satisfied with its behaviour. They had equipped their works at Hayes with a complete apparatus. That they were not alone in looking for a greatly extended use of electricity for cooking was shown by the fact that some 25 manufacturers were contemplating starting the making of electrical cooking apparatus. They believed their system was the best, and this was borne out by the fact that some 28 supply authorities were now hiring their cookers. Their experience in manufacturing both transformers and cookers led them to think they would continue to hold the position they held that day. In conclusion, the chairman again referred to the work of the staff, and expressed the belief that the company owed much of its success to the fact that so large a portion of its shares were held by the directors and their friends and by the staff.

MR. T. ROWE seconded the motion.

In the subsequent discussion questions were asked as to circulars coming addressed from Copthall House offering large blocks of shares of the company for sale, and as to the attacks made on the company by a financial print. It was also asked what connection there was between the company and "Modern Kitchens, Ltd."

The CHAIRMAN said the board had no control over any circulars outside brokers might issue. The company running the Tricity House restaurant, which was equipped exclusively with their cookers, were, he was glad to say, doing an extraordinarily good business. As a company they had a small interest in it, but they had a great interest in it from the point of view that it was teaching the public to appreciate their cookers, and already it had done a good deal of good to them. With regard to the competition of other makers, if they produced good cookers it would all help to make such apparatus popular.

The report was then adopted.

Lancashire United Tramways, Ltd.

THE HON. ARTHUR STANLEY, M.P. (chairman), presided on February 27th, at Winchester House, E.C., over the annual meeting.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 357), the CHAIRMAN said that there was a profit of £19,466, which showed an increase of £281. The profits were the highest figure they had yet reached, and were obtained in spite of the coal strike, which, of course, was a heavy loss to them. The receipts per car-mile were 8·21d., which was also the highest figure they had yet reached. The units sold to outside consumers were 1,025,000, as against 660,000 last year, showing a very satisfactory increase of 364,000 units. They might hope that that would be very considerably increased this year, because under the arrangement with the Lancashire Power Co., who had certain rights in the district, they had arranged to supply the urban district of Tyldesley. The load they were at present carrying, and this new load, had necessitated a new battery and a turbine. The new battery was already erected, and they had made arrangements for erecting the turbine at once. When they had got the new turbine they would be in a position to cope with any load that they might expect to get for some time to come, and there was not likely to be much more capital outlay under these heads. They proposed to construct a short bit of new line. They had been able to make very satisfactory arrangements with the local authorities for the necessary powers, and also for the maintenance of the road, and he hoped, therefore, they would be able to run that section at a profitable rate. It was a continuation of one of their lines, and would join up to their main system a rather important district which had been very anxious to see the tramways there. It also would enable them to make effective use of about half a mile of line which was laid, but which hitherto they had not been able to work. As regarded finance, they had left with the companies they controlled after paying dividends £6,900, and the depreciation and renewal funds they had built up in those companies, now amounted to £16,400. It was quite certain, now that their lines had been running some years, that they would have a good deal to spend within a little time on renewals, and they would all agree that it was wise that they should build up the fund in anticipation of the work they would have to do. In a company like that, which had to be very carefully worked, and where the increase each year was not very large, it was important that it should be progressive. It was only by taking a series of years that they could really see the increases which were made. He had taken 1909, not because it was a particularly good year, but because it was a convenient year, and there was no better year before it. In 1909 they carried 13,450,000 passengers, whilst in 1912 they carried 14,500,000, or an increase of over 1,000,000. The traffic receipts in 1909 were £68,900, and in 1912 £72,400. The sale of electricity was rather a remarkable figure, for while in 1909 it was only £690, in 1912 it was £2,500. The total revenue in 1909 was £71,500, and in 1912 £77,600. Perhaps the most gratifying feature was that the increase had been secured at a cost of under £1,900 increase in the expenditure on the lines, and therefore he thought they might say with absolute confidence that the position in 1912 was materially better than in 1909. He thought that great credit was reflected on the secretary and other officials who managed the lines. He could assure them that it was a very complicated business to work if they controlled various lines which worked under different conditions. It wanted very careful watching, and the proof that vigilance was being exercised was shown in the increasing returns, and the fact that expenditure did not increase to a corresponding extent.

SIR J. BEECHAM seconded the motion.

MR. NEWGASS, whilst sympathising with the directors, remarked that friends of his at Liverpool had told him that if there were certain outlays the returns could be materially improved. They

had motors running over their lines and damaging the road, and could the company not carry goods traffic itself?

Mr. Taylor complained that the accounts did not enable them to form an intelligent opinion of what was actually being done on the tramways, and it would help them if more statistics were given of what was actually being done. He thought the working expenses were high, and compared unfavourably with other companies.

The Chairman, replying to the criticisms, pointed out that if they could not raise money at a good rate it was certain they could not use it in the district in a remunerative way. If Mr. Newgass had known the difficulty they had over the prior lien bonds he would realise that the chance of raising capital at a remunerative rate was very remote. They did once have a great idea of the possibilities of goods traffic, but, after going most exhaustively into the whole matter, they could not see how they could fit such a service in practically with the passenger service. With regard to the prospectus they issued for the prior lien bonds, they had the advice of Mr. Salter and Mr. Sellon, and that the results had not come up to anticipations was due to many circumstances it was impossible for him to go into at the moment. He would not venture to make any prophecy as to when they were likely to get a dividend.

The report was then adopted.

W. T. Henley's Telegraph Works Co., Ltd.

The annual meeting was held on Friday last at the offices, 13 and 14, Blomfield Street, E.C., Mr. Sydney Gedge, M.A., presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 358), said that when a company could show such a good balance-sheet as they were able to show this year, succeeding, as it did, similar balance-sheets for a good many years past, it would be strange, indeed, if they had to find any fault with the directors. During the year they had made a profit of £92,068. They had spent £32,483 upon additions to their buildings. Out of the balance of £42,164 they proposed to put £13,790 to depreciation for buildings and machinery. It was quite right to do that, but it did not mean that the money had gone out of their pockets, it was still in the business. They had also written a further £4,219 off their trustee securities. He could not say how long that depreciation was going to continue. Personally, he thought that until there was a change in the Government of the country that depreciation was likely to continue, and he might say that since December 31st their securities had depreciated a further £3,000. He hoped that something would happen in the course of the next year or two to cause consols and other gilt-edged securities to go up again. They had put £15,000 to the reserve account, bringing it up to £200,000, and they carried forward £8,155. He thought they would agree that that was a very strong position for an industrial company to be placed in. During the year they had considerably increased their office accommodation, and also their warehouse accommodation in the basement. They had also made considerable additions to the works. The directors had, in accordance with their usual custom, held board meetings at Gravesend and Woolwich, and been over the works, and he thought they were all very pleased with them. Everything was in very excellent order. The whole of the business had worked very smoothly during the year; there had been no strikes; the health of the workpeople had been good, and there had been no accident of any moment whatever.

Mr. George Sutton, the managing director, in seconding the motion, said the report was as good as shareholders could possibly expect. It represented a year of intense work and of full employment at both factories. It represented the largest turnover that the business had ever done, and that with prices not above the normal. The satisfactory feature of this increased turnover was that it was not due to any one or two abnormal contracts, but, almost without exception, the business had increased in every part of the world. He wanted them to understand that the improved profit was not due to a larger profit upon their goods, but to a larger turnout of material. There were two factors which had contributed to the excellent results of the past year, namely, labour and raw material. In the case of labour, they had had a year of peace; they had had no trouble at either of their factories. There was no bitterness left in the minds of either employers or employed as a result of the strike of 1911. The improvement of the conditions of their workpeople as well as of the staff was always in the minds of the managers; they did not wait to be pressed by Trade Unions or other people to do justice to their workpeople. Perhaps there was one echo of the strike during the past year, and that was, that efforts had been made to induce certain of their municipal customers to refrain from renewing their contracts with them. Of course, those efforts were not made by their workpeople. He knew the source from which they emanated, but he had the satisfaction of telling them that in no single instance had they succeeded, and three of their largest customers who were approached had renewed their contracts with the company. As to raw material, as the shareholders were aware, the principal materials in which the company dealt were copper, lead and india-rubber. They had had no boom in any of those materials during the past year. Booms were no doubt very exciting and enjoyable to a large section of the public, but they were very embarrassing to manufacturers who had to use the boomed articles. The fairly level prices which they had had throughout the year, had kept a continuous stream of orders coming in to the works, whereas when prices were unreasonably high, as they were two or three years ago in the case of india-rubber, buyers were apt to wait and wait until the pendulum swung to lower prices before they sent in orders, and so the equilibrium of trade was upset. As to the future, he could speak with a pretty sure prophetic voice; they were going to be all right this year, because their order sheet at the present time was the largest they had ever had. With regard to the future beyond 1913, the directors were looking with a considerable amount of hope to the electrification of railways, which business ought to bring a great deal of grist to the company. They had no reason to suppose that they would not get a fair share of orders for cables which would be needed in that direction. They had one order on their books for £100,000 for the construction and laying of cables for the electrification of a portion of the Central Argentine Railway—the largest order of the kind which had ever been placed. He might say that at the new works, which they were putting up at Gravesend, it was intended to manufacture pneumatic motor tires.

After some complimentary observations by shareholders, the report was adopted.

London Electric Supply Corporation, Ltd.

Mr. R. H. Benson presided, on February 27th, at Winchester House, E.C., over the annual meeting.

The Chairman, in moving the adoption of the report (see Electrical Review, page 358), first referred in sympathetic terms to the late Lord Crawford, one of the original directors and the late chairman. To fill the vacancy they had elected Lord Duncannon who, probably, before long, would again be in Parliament, when he would be in a position to render them valuable service. Further, his close connection with the chairman of the Brighton Railway, with which they already had large dealings and expected larger to come, should tend to the best mutual understanding, and they welcomed any occasion for cementing still more closely the already pleasant relations which had always existed between the Brighton Railway Co. and themselves. Those who had studied the accounts could not fail to have noticed that in three respects the year under review constituted a record:—First, in the actual number of units sold, 28,409,755, an increase of 8,000,000 over the best preceding year; secondly, in the gross receipts for sale of current, the figures being £138,000, as against £125,000, the next highest total, in 1905; and lastly, in the cost of generation per unit sold, namely, '66d., as against '82d, a decrease of 20 per cent. They might fairly claim this as a most satisfactory showing, and one which was full of promise for the future. It was true that the net revenue had not risen sufficiently to enable them to increase their dividends, but it did show an increase of over £7,000, and but for the necessity now imposed on them of creating a sinking fund for the repayment of their debentures in 1931, which required £12,000 a year, they would have had a larger surplus to divide. They proposed payment on the ordinary shares of the same dividend as last year, viz., 2½ per cent, carrying forward £4,706; £1,000 had been placed to contingencies' account, and owing to the provision of the sinking fund, to which he had referred, it had not been thought necessary to increase the reserve, which remained at £77,500. He should like to anticipate a question which some shareholders might be inclined—and very legitimately inclined—to put to them: "You tell us year after year," it might be said, "of the progress which the company is making, of the increase in the number of the units sold, and of the decrease in the cost; and yet our dividend remains the same. What isthe advantage of all this to us? You are continually issuing fresh capital, but this capital does not appear to do more than earn its own interest, andthe ordinary shareholder is not benefited." This was a natural, and, as he said, a legitimate objection, and he would endeavour to meet it. He had a comparative table showing gross and net revenue, debenture interest, dividends, and surplus placed to reserve, for the last 12 years, beginning 1901, which provided the answer to the question they were considering. It showed that in the year 1906, the year which followed those two exceptional years in which they were supplying current to the L.C.C. for their tramways pending the completion of their own supply station, there was a fall in the gross revenue from £130,591 (this included all other sources of revenue as well as current) to £112,039, and in the net from £78,721 to £56,522. In the following year, 1907, there was a further drop to £105,539 in the gross and £46,320 in the net. That was the low-water mark, viz., the year 1906. During those years they were supplying very little current for power purposes. But directly they began—towards the end of 1910—to supply current to the Brighton Railway for traction purposes, and to manufacturers and industries, as well as for light, their revenue, both gross and net, began to expand. The secret of cheap power was to supply it for all purposes and for the greatest number of hours out of the 24, so as to keep the machinery steadily running. The year just past was the first year in which their two new turbine plants were running—and even then not for the whole period; and the result, as they saw, was an expansion in gross receipts of £15,000, and in net of £7,000, or nearly 12 per cent., while the units sold had increased from 20,000,000 to 28,000,000. What was the conclusion to be drawn from all this? Was it not that the work they had been carrying on during these past years had been work of preparation—arduous, but necessary for the harvest which, he thought, was in sight? During the past nine years they had increased their preference share capital by £200,000 and the debentures by more than £100,000; but even in these comparatively lean years of preparation they had earned interest on this money, and a small dividend besides and had

strengthened their position so much that they were producing current considerably cheaper per B.T.U. than any other company in the London area. The board long since came to the conclusion, and it had been often stated from that place, that it was in the generation of current for industrial and traction purposes, combined with lighting, that the prosperity of the company lay. In the lighting field they were out-distanced by more fortunate competitors who had benefited by their pioneering experience, and whom they could not hope to displace. It was for this reason that they turned their attention to obtaining large power contracts, and that they concluded with the Westminster and St. James' companies agreements which were intended to eliminate waste competition for lighting, and give the most efficient service in the areas which they served along with those companies. They were entitled to claim that the event had amply justified their action. Any attempt to develop their lighting field further could only have resulted in a cut-throat competition, which, while it might have damaged their rivals, would probably have brought them very little increase of revenue, and he had no hesitation in saying that without the load for traction and industrial power, and relying only on their lighting units, it would have been impossible to get any fair return for the service rendered to the public. Their contract with the Brighton Railway Co. had now been in full operation for not much more than two years. In February, 1910, he said that in the (then) coming year they expected to sell them over 5,000,000 units, and hoped for much more. Well, last year that 5,000,000 was increased to nearly 15,000,000; and that was nothing to the demand which they expect shortly to be called upon to meet. The board of the Brighton Railway, had now decided to complete the electrification of their entire suburban system; and they had good reason to expect that they would come for their supply of current to the company with whose co-operation during the existing contract they had more than once publicly expressed their satisfaction. Their demand might amount to anything, from a minimum of 80,000,000 units up to as much as 150,000,000. Now, as a general principle, and leaving out of account exceptional factors such as a sudden rise in the price of coal, as the number of units generated increased, and the load factor rose, so did the costs of generation tend to fall. Therefore, without his labouring the point further, they would see that in a contract for the supply of power on such a scale as this, when combined with a supply to other customers for industrial purposes, there should be room for profits sufficient to place their ordinary shareholders at last on the footing which they certainly had a right to expect, and for which they had so long and patiently waited. And this brought him to another point—the question of capital. It was obvious that they could not meet so big a demand upon them without a large extension of plant; and that would involve the finding of fresh money. For this purpose they were submitting that day a resolution for increasing the capital of the company by £250,000, to be "divided into shares of such denomination, either preference or ordinary, as the board may determine." That would also increase their borrowing powers, which were now exhausted. They did not anticipate that any of this fresh capital would be needed during the current year, but they wished to be prepared for any emergency. As the length of their tenure diminished, the difficulty of finding fresh capital, of course, increased, for they had to provide for its repayment if they were taken over by the purchasing authority in 1931; and as they had seen in the case of the recent issue of debentures, this had necessitated the provision of a very heavy sinking fund. But their financial advisers were confident that for the purposes of undertaking so important a contract as that on which they hoped shortly to be called upon to enter, there would be no difficulty in finding the necessary capital. In conclusion, he would like once more to bear testimony to the spirit of zeal in which everyone in the company's employment, from highest to lowest, worked for the furtherance of its interests. In a few months their managing director, Mr. Bain, and the chief engineer, Mr. Partridge, would have completed 25 years in the service of the company. They entered upon their duties together soon after the company came into being, and they had worked together, with unflagging keenness for its interests from that day to this. They had so far identified themselves with the company that it was not too much to say that its success was their life's work; and it was a work of which they had a right to be proud, for they had seen the company through many dark days, and it was only by untiring watchfulness, patience and persistence that they, working with the late Lord Wantage as chairman, piloted it to the position that it now occupied. He should like, therefore, in conclusion, to invite them to pass a special vote of thanks to Mr. Bain and Mr. Partridge on the occasion of the completion of their twenty-fifth year of service with the company, which they would hope might also coincide with the signature of a new and profitable contract with the Brighton Railway.

Mr. Stewart Bain (managing director), in seconding the motion, first thanked the chairman for his references to the approaching semi-jubilees of himself and Mr. Partridge, and said he would like to take the opportunity of testifying to the great assistance he had always received from Mr. Partridge. He also endorsed what had been said by the chairman regarding the late Earl Crawford. The capital expenditure for the year was £46,631, as compared with £73,000 last year. This was less than was anticipated, and nearly the whole of it was in connection with the Brighton Co.'s contract. They laid about 6½ miles of new mains during the year, bringing the total number of mains laid up to 196½ miles. They did not anticipate a very large expenditure this year, but when the new contract with the Brighton Railway Co. in connection with their extension came along, very considerable extensions to their plant and machinery and mains would have to be met. Some idea of what it might be might be obtained if he read an extract from a recent article in the *Times*, viz., "The supply of electricity taken from the London Electric Supply Corporation has proved so satisfactory, that it is intended to purchase all the current required for operating the suburban system from the same source. In consequence that company will have to install additional plant amounting to some 40,000 or 50,000 KW., and their power station at Deptford will become one of the largest, if not the largest, in the country." With regard to the revenue account, the total expenditure was about £8,000 more than in the previous year, but as the generating expenses alone were about £9,000 more, the expenditure under the other heads of the account was about £1,000 less. The average price paid for coal during the the year was 10d. per ton more, but owing to the precautions they took in building up a large stock of coal they had no difficulty in meeting every demand upon them. The gross revenue showed an increase of £15,000 over last year. The average price received for every unit was about 1¼d., as compared with 1½d. for the previous year—a reduction of about 20 per cent., and it spoke well for the efficiency and zeal of the staff that the total cost had fallen from 8·2 to 6·6 per unit. This latter figure was one which their engineering staff had every reason to be proud of. They were paying special attention to the supply of power for industrial purposes, and manufacturers were gradually realising the economy, efficiency and facility of electric driving, as compared with steam driving. Generally, the year had been one of progress, and the future was not only hopeful but bright.

Mr. Makins suggested that with regard to the debenture redemption fund, it would be well if the company purchased its own stock. He also urged the board to take care in negotiating the Brighton Railway contract, as it might be that a few years hence the railway company might think it better to generate their own electricity.

Mr. Hankey said he was glad they had heard the chairman give them some hope for the future. They seemed so far to have been a philanthropic company to provide electricity first for the London County Council and then to the Brighton Railway Co.

The Chairman, in reply, said that they were acquiring their own debenture stock, and last year for £12,000 they purchased £13,353 worth of stock. The present contract with the Brighton Co. had 15 years to run, and it went without saying that they must have a sufficiently long contract to make it pay.

The report was then adopted.

The necessary resolutions for increasing the capital as explained in the chairman's speech were carried.

On the motion of Mr. Ince, seconded by Mr. Hankey, a special vote of thanks was passed to Mr. Bain and Mr. Partridge; and the latter gentleman, in acknowledging it, said the progress being made by the company was due to the wonderful engineering staff they now had. He had visited many stations on the Continent, and nearly all the stations in this country, and had never seen a more competent staff than they had at Deptford.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The annual meeting was held on February 28th at the offices in Newcastle-on-Tyne. Dr. J. B. Simpson, chairman of directors, presided.

The Chairman said the issued capital was the same as last year, but it had been fully paid up during the whole year, and consequently the amount required for the same dividend was considerably more than it was in the previous year, when only a small part of the new capital was dividend earning. The reserve and depreciation account had been increased by the transfer of £9,000 out of the year's profits, and amounted to £33,350. Their capital expenditure had been increased by £43,600, which represented further payments made in connection with Grangetown, Port Clarence and Ayresome generating stations. These stations had been completed during the year, and had produced a considerable increase in the revenue of the company. Their investments had been increased by £17,000 by the payment of the balance on the new shares taken up in the Bankfoot Power Co., Ltd. The profits of the Waste Heat Co. showed an increase of £10,939 on the previous year, which was owing principally to the starting up of new generating stations. All the company's stations were running very satisfactorily, and had it not been for the miners' strike in the early part of last year, the profits would have shown a still further increase. As it was, however, the coke ovens and ironworks, from which they obtained the waste heat and gas, were shut down during the period of the strike, and in consequence the generating stations had to be closed down also. The revenue from the production of electricity was reduced to nothing during the period of the strike, but at the same time, of course, they had no payments to make for waste heat or gas. Advantage was taken during that period to thoroughly overhaul all the plant in their stations, which was consequently in a thoroughly efficient state of repair. The directors had not yet concluded any further agreements for the erection of new generating stations, but proposals were still under consideration, and they hoped that during the current year agreements would be finally concluded whereby one or more additional generating stations would be erected by them. The character of their business was, he though, so far as this country was concerned at least, unique. They purchased waste heat from the people who had it, converted it in their stations into electric power, and sold the electricity in bulk to power companies, by whom it was distributed throughout the district. Their contracts with the power companies were very simple. As that company could supply

them with power from the waste heat stations more cheaply than the companies could produce it in their coal-burning stations, the power companies were glad to take from them as much power as the stations could generate. In addition the former companies bore the cost of operating the stations, and kept them in repair and paid that company a rental for the use of them. The expense of obtaining a sale for and distributing their product, which was such a large and growing item in the expenses of most companies who manufactured and sold, was borne by the power companies, which placed them in a specially favourable position. On the other hand, the supply of cheap power was of the greatest possible benefit to the power companies, and ultimately to the consumers. But the Waste Heat Co.'s operations were more than this—they were of great advantage to the ironmasters and coalowners in that district. Not only did they earn a substantial revenue from energy which was formerly wasted, but that company also supplied them with electric power for their own use at a price and with a reliability which they could not obtain by themselves. The fact that all their stations were linked together and with those of the power companies enabled a continuous supply to be given throughout the year.

The report was unanimously adopted.

Para Electric Tramways and Lighting Co., Ltd.

SIR WILLIAM EVANS GORDON (chairman) presided on February 28th, at the Cannon Street Hotel, E.C., over the annual meeting.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 358), said it was the most satisfactory they had ever had. The hope he expressed at the last meeting regarding a reduction of operating expenses had been fulfilled. The results of the improvements in the plant, and the cessation of interference with their operations, which was caused by the construction of the Port Works, had come up to their expectations, and they were able to show the substantial decrease in total operating expenses of £17,317. He would remind them, however, that this decrease was not fully apparent by a comparison of the figures in the respective reports. This was due to the fact that a different rate of exchange was used in their accounts in the two years. For the past year the rate had been altered from 15d. to 16d. per milreis. This rate of 16d. had now been fixed as the legal rate by the Brazilian Government. For the purpose of a true comparison, therefore, the 1911 figures must be converted at the rate of exchange of 16d., and this had been done, as closely as was now possible without reanalysing every item in last year's accounts. The number of passengers carried increased by 766,546, and the operating expenses fell from £132,200 to £124,304—a decrease of 6 per cent. The result in net gains over last year's figures was £8,147. As regarded the lighting branch of the business, the gross receipts decreased from £95,510 to £94,610, but the operating expenses fell from £52,468 to £43,047, or a decrease of 18 per cent. The net result on the lighting was, therefore, a gain over last year of £8,521. To sum up, the percentage of operation to gross receipts over the whole year was 54 per cent., against 59 per cent. for the previous year. It was satisfactory to know that the number of their lighting customers during the year increased by 14 per cent., and, as regarded the slight decrease in gross receipts, he might say that this was accounted for by the extended use of metallic-filament lamps, and also by some reduction in the public or street lighting. Turning to the capital expenditure, they spent on capital account £24,637. The principal items for which this expenditure was made were a new 600-KW. traction set, a new boiler already in service, and material for two further boilers not yet completely erected. They had also to provide for extensions in their lighting system, and a considerable increase in the number of consumers' meters. This expenditure was required for meeting the growth and progress of the undertaking. The sum of £4,654 had been written off capital expenditure and charged to the reserve for renewals account. This sum represented the value of an old unit of 240-KW. capacity replaced by the 600-KW. set, and an old boiler replaced by the new one. In this way they followed the usual practice of writing off new expenditure, which did not increase their actual earning capacity. They had to face the fact that the rubber position, upon which the prosperity of Para largely depended, was at present not very satisfactory, and that a period of depression was being experienced, and might continue. It was, indeed, most encouraging that during this depression their business had continued to do so well, and no signs of bad times were noticeable in their results. But they considered it wise to be amply provided against any trouble that might occur, and felt that their financial arrangements this year placed them in a very secure position. In the spring of 1912 their manager in Para, Mr. P. C. Barley, was taken seriously ill, and was compelled to return to England, and, they regretted to say, had been unable to resume his work in Para. Mr. C. H. Julius, of Messrs. J. G. White & Co., Ltd., their engineering managers, at once proceeded to Para, where he remained for several months. The directors fully appreciated his efforts and ability in the operation of the property and in reducing operating expenses. The retirement of Mr. Barley had led to several changes in the operating staff. Mr. Walter Binns, formerly of the Reading tramways, had been appointed general manager. He took up his duties in December last, and they looked forward to continued and increasing prosperity with him in charge. They had also been fortunate in obtaining Mr. J. P. Kemp, who was in charge of the Birmingham electric supply station, as the chief station engineer, and with these two additions to their existing well-tried and loyal staff, they felt that their property was in the safest possible hands. As to the future, he did not believe he could give a better indication than to tell them that for the first two months of the current financial year the gross receipts of the undertaking had increased by £3,575, and the surplus, after providing for all charges, including preference dividend, was increased by £2,451 over the corresponding period of 1912. The weekly gross tramway takings to date showed the continued maintenance of satisfactory increases. Every effort was being made by the board and by the engineers to still further reduce expenses and improve operating results. The new governor and new Mayor had just taken their seats, and strong efforts were being put forward by them and the Federal Government to foster the great resources of the Amazon country.

MR. E. C. CHESTON seconded the motion, and the report was adopted without discussion.

MR. W. J. FISHER proposed a vote of thanks to the board, and this was carried.

City of London Electric Lighting Co., Ltd.

THE directors report that capital expenditure on additions, extensions and replacements during the year 1912 cost £45,509, and there has been written off in respect of buildings, plant and other works dismantled £191,150, leaving a net expenditure under capital account at £2,000,324, a net deduction of £145,642. £176,841 of the amount written off represents the cost of engines and generators erected in succession to the original pioneer plant. The bulk of this plant was retained as a measure of precaution until last year when the completion of the erection of turbine generators of the most modern type permitted its removal. It is the intention of the directors to continue their policy of replacing any further plant which from time to time may become obsolete or uneconomical in operation, as they consider that this policy is in the best interests of the shareholders both as regards the earning of profits in future years, and the maintenance of the plant in the highest state of efficiency in view of ultimate purchase by the L.C.C. upon the terms of the Electric Lighting Act, 1888.

The directors have credited the first debenture stock premium redemption account with £1,476 from revenue for interest, raising the amount at the credit of the redemption account to £62,961. They have also transferred £50,000 from net revenue account to reserve account. The balances at credit of the reserve funds total £240,164, including dividend equalisation account balance, £7,352. Amount to be carried forward to 1913, £24,333.

The total revenue for the year, including interest on investments and discounts (£2,710), was £300,619, from which must be deducted the following items:—Expenses of generation and distribution, £70,131; repairs and maintenance of buildings, machinery, plant, mains and other works, £10,960; rent, rates, taxes, management expenses and special charges, £55,847; leaving £163,681, plus £25,943 brought forward, making a total available revenue of £189,625. Of this sum the following amounts have been distributed or provided for:—Interest on loan from bankers, consumers' deposits, &c., £2,787; interest on first and second debenture stock for year ended December, 1912, £31,546; interest transferred to debenture stock premium redemption account, £1,476; leasehold redemption account, interest and appropriation, £269; contributions to employés' provident funds and under National Insurance Act, £1,804; stores, written down, £1,628; transfer to reserve account, £50,000; leaving available for dividends on preference and ordinary shares and for "carry forward" to 1913, £100,115. The directors now recommend the following dividends for the year ended December 31st, 1912, subject to deduction of income-tax:—Preference shares, 12s. per share (6 per cent. per annum); ordinary shares, 16s. per share (8 per cent. per annum), as against 8 per cent. for the previous year. These absorb £75,782, leaving £24,333 to be carried forward. The directors also propose to distribute a bonus of 2s. per ordinary share, less income-tax, out of the amount standing at the credit of the dividend equalisation account. This fund was set aside out of profits in past years in order to ensure the maintenance of a 7 per cent. dividend upon the ordinary shares, it being then impossible to foresee to what extent the company's revenue might be reduced by the introduction of the metallic-filament lamp. The directors, however, are glad to say that the loss so caused has been almost counterbalanced by the progressive consumption of electricity for other purposes than lighting, and, as the metallic-filament lamp has now been adopted by practically all lighting consumers, they consider it is no longer necessary to retain the full amount of this fund, but they propose to leave the balance of £7,352 for the present. The following comparative tables show the position of the company:—

REVENUE.	Dec., 1910.	Dec., 1911.	Dec., 1912.	+ over 1911.
Gross revenue	£282,129	£291,584	£300,619	£9,035
Net revenue	£156,755	£161,866	£163,681	£1,815
Div. on ordinary shares ..	7 %	8 %	8 %	—

Private supply for all purposes: average prices per unit obtained.

1909.	1910.	1911.	1912.
2·49d.	2·45d.	2·39d.	2·37.

The following show total number of customers and connections, after allowing for disconnections (private supply) on account of removals, substitutions of metallic-filament lamps, &c.:—

	1910.	1911.	1912.	+ over 1911.
Number of customers	13,876	14,246	14,729	483
KW. connected (including power and heating) ..	37,127	39,122	41,151	2,029

On February 19th, 1913, there were 42,341 KW. applied for, out of which 41,290 were connected, and the customers numbered 14,789. The following are the total units generated, sold, utilised on works, &c. (including public street lighting):—

	1911.	1912.
Generated	30,527,715	32,220,338
Sold	26,638,759	27,488,860
Metered and used by company	1,183,635	1,429,784
Expended in distribution, &c.	2,710,321	3,301,694
Maximum supply demanded, KW.	17,762	18,510

The total units sold during 1912 show an increase of 855,101 over 1911.

Power and heating supplies continue to show a steady increase, the total units sold for these purposes in 1912 being as follows :—Power, 9,280,870 units ; heating, 1,670,275 units, = 10,951,145 units, or equal to 41·6 per cent. of the total units sold for private supply. It is hoped that during the present year active progress will be made with the reorganisation of the public street lighting in accordance with the tender already accepted by the Corporation. Wayleaves for attachments to buildings are being obtained by the Corporation, but these necessarily take some time to negotiate.

At the ordinary general meeting of the company, held on March 4th, 1903, a resolution was passed constituting the company a contributing company of the British Electrical Superannuation Fund, and authorising the directors to make annual contributions to that fund on behalf of members of the company's staff. Owing to an adverse actuarial report necessitating the reorganisation of that fund, the directors and those of the company's staff who were members of the fund decided to withdraw therefrom. After very careful inquiries and consideration the directors decided that it would be more advantageous to the company and its staff to form a Staff Provident Fund, taking as a nucleus the amount of £8,954, which was received by the company as the share of the assets belonging to those members of its staff who were members of the British Electrical Superannuation Fund.

The directors have also decided that contingent provision should be made by the company for making appropriate grants where circumstances call for such assistance, with due consideration to long service and good conduct on the part of the employés concerned. The shareholders will be asked to approve and confirm by resolution the action of the directors in making annual contributions for this purpose and to aid the staff in providing systematically for the eventualities of the future.

The directors' report contains the following references to the question of purchase of the undertaking :—

"Your directors desire to call attention to the fact that the company is approaching the date, August 18th, 1914, at which (or within six months of which) the Corporation may give notice of its desire to purchase the company's undertaking in respect of the City of London and, in view of the interest which has already been aroused upon this subject, the following extracts from the company's provisional orders relating thereto, are quoted for the information of the shareholders. It will be noticed that, so far as public lighting is concerned, the terms of purchase are to be those contained in Sec. 2 of the Electric Lighting Act, 1888, but as regards the remainder of the undertaking, by agreement, or as, in default of agreement, may be determined by arbitration."

EXTRACTS FROM PROVISIONAL ORDERS.

Eastern District (Laing Wharton & Down). Royal Assent, August 18th, 1890.

Sec. 61.—The local authority may within six months after the expiration of 24 years from the commencement* of this order, by notice in writing require the undertakers to sell, and thereupon the undertakers shall sell to them so much of the undertaking as relates to public purposes, and also, if the local authority so require, so much of the undertaking as relates to private purposes.

So far as relates to public purposes, the said purchase shall be on the terms specified in Sec. 2 of the Electric Lighting Act, 1888.

So far as relates to private purposes, the said purchase shall be upon such terms as may be agreed upon between the undertakers and the local authority, or as, in default of agreement, may be determined by arbitration.

Central District (Brush). Royal Assent, August 18th, 1890.

Sec. 59B.—The local authority may within six months after the expiration of 24 years from the commencement* of this order, by notice in writing require the undertakers to sell, and thereupon the undertakers shall sell to them so much of the undertaking as relates to public purposes, and also, if the local authority so require, so much of the undertaking as relates to private purposes.

So far as relates to public purposes the said purchase shall be on the terms specified in Sec. 2 of the Electric Lighting Act, 1888.

So far as relates to private purposes the said purchase shall be upon such terms as may be agreed upon between the undertakers and the local authority, or as, in default of agreement, may be determined by arbitration.

Western District (Brush). Royal Assent, August 5th, 1891.

Sec. 2.—The City of London Electric Lighting (Brush) Order, 1890, hereinafter called the principal order, and this order shall be read and construed together as one order, and may be cited as the City of London Electric Lighting (Brush) Orders, 1890 and 1891.

Sec. 10.—The period of 42 years mentioned in Sec. 2 of the Electric Lighting Act, 1888, shall for the purposes of the principal order and this order be reckoned from the commencement* of the principal order.

[* *Commencement = Date of Royal Assent.*]

The annual meeting is called for March 12th, at Salisbury House, E.C.

Charing Cross, West End and City Electricity Supply Co.

Mr. W. F. Fladgate (chairman) presided on Tuesday at the offices, St. Martin's Lane, W.C., over the annual general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 357), the Chairman said he was glad they were not this year in the unhappy position they were last year, viz., in the middle of the coal strike, although labour troubles did not seem to have ended, and they might have something to meet in the course of the current year. At the last annual meeting the coal strike was absolutely at its height, and the board were filled with very great anxiety as to what might be the effect upon the company's affairs. He was happy to say that the strike was dealt with, and they emerged from it without any very great loss. Of course, expenses were increased consequent upon it, but the effect of the care and economy with which their engineer ran their stations had been that he was able to put before them a statement of accounts which he considered exceedingly satisfactory. No alterations in the share or debenture stock had been made during the year. They only spent £30,000 on capital account, and part of this was in the purchase of freeholds, and part in the erection of an oil fuel tank at the Bow station in order to provide against emergencies in case of further coal strikes or future difficulties in maintaining their fuel. There was no need to trouble them with the details of the revenue account, because the corresponding figures of last year were set out in the accounts, and further the figures showed little variation. The only real difference was that in the West End stations they had generated rather more electricity, and the results as a whole were satisfactory. From the West End undertaking in 1911 for an expenditure of £69,000, they brought in on account of sales £135,862. For the year 1912, with an expenditure of £66,000, they brought in sales to the extent of £141,989, or between £6,000 and £7,000 more, and this showed the result of the economies. To get the gross figures they had to bring in the meter rentals and other small receipts, which brought their total receipts for 1912 up to £146,675, as against £140,900 for 1911. These figures gave them the sum of £79,889 to deal with, or with the £15,949 brought forward, a sum of £97,883. Out of this they had paid the debenture interest, amounting to £17,829, and provided £15,000 for depreciation, which was somewhat in excess of what they had been accustomed to. They had also placed £9,054 to the general income reserve account. They had opened this account because they did not think it right to carry forward a very large figure, and because it would be well to set up an intermediate account on which they could draw for different purposes, and they proposed to add to that from year to year. This left £56,000 for division, out of which they had paid the preference dividend, amounting to £18,000, and recommended a dividend of 5 per cent. on the ordinary shares, which would absorb £20,000, and leave £18,000 to be carried forward. Some might think with such a satisfactory state of affairs they might have been tempted to declare a higher dividend, but after careful consideration, the board felt it would be better to increase the reserve funds. It would be remembered that last year they had to make a very large inroad into those funds, and had to write off practically the whole of the value of the Lambeth station, and the effect was to decrease their depreciation funds until they did not stand at a very high figure. Consequently they thought it wiser to have respect to the depreciation fund first and consider the dividend afterwards. The business had increased, but not by a very large extent. In the West End undertaking the increase had only been 5·7 per cent., or 686,000 lamps in 1912, against 649,000 lamps in 1911. They could not expect in these West End districts to increase with the same rapid strides as at first, but in the current year they did hope for a somewhat larger increase consequent upon the fact that the property in and around Kingsway, which had been lying unoccupied for so many years, was now apparently beginning to be dealt with. The demand for energy for heating and power was increasing in the West End, and no less than 34 per cent. of their whole load was used for these purposes, which necessarily brought down the average price for the units sold. Last year they sold 6·1 per cent. more current than in the previous year. He was glad to say that in the present year the loss on transmission was smaller than for some time past. In 1910 it was 28 per cent., in 1911 26 per cent., and in 1912 23·9 per cent, which was a benefit of 2 per cent. With regard to the City undertaking, they had not made a high rate of progress, but it was satisfactory. They had spent £21,000 on capital account, principally in the purchase of turbines for the Bow station. For 1911 the total expenditure was £84,356 and in 1912 £84,958, an increase of only £600 ; but the expenditure in 1912 produced £147,198, as against £144,299 in 1911. Therefore, with a slight increase of £600 in the expenditure they had earned some £3,000 more. Bringing in meter rentals, &c., the total was £148,513, against £145,671, and bringing in the carry forward from the previous year, they had £99,712 to deal with. They had paid the debenture and loan interest, amounting to £30,891, which left £68,820. The preference dividend took £18,000, and they had opened a general reserve fund on the City undertaking, to which they had put £32,820 17s. 10d., leaving to carry forward to revenue account £18,000, which was the amount of the preference dividend for the coming year. This result was exceedingly satisfactory in view of the fact that they were working against the coal strike for a considerable part of the year. The coal cost per unit in 1911 was ·270d., and in 1912 it increased to ·273d., being an increase of 1 per cent. on the whole cost to them of the coal they bought. But the price of coal during that period had increased by 13 per cent. Fortunately, owing to the economies practised by their engineer, the coal burnt per kilowatt, which in 1911 amounted to 4·7 lb., in 1912 only amounted to 4·2 lb., or a decrease of 11 per cent. As usual, the auditors pointed out that there was no depreciation fund for the City, but, as he had before pointed out, the form of their provisional order was such that they did not consider it right or advisable to absolutely set up such a fund, but they had set up a reserve fund to which he had referred, and they proposed to add to that fund in the future. The demand in the City had increased by 4·2 per cent., but the load in the City was now over 50 per cent. for heating and power, and under 50 per cent. for lighting which brought down the price. The losses on distribution were not so satisfactory in the City as last year, but the engineer pointed out that the reason was that last year, when their losses were only 26·2, there was an abnormal figure as regarded losses through their meters. That figure last year the engineer admitted he did not understand. It was 2 per cent. less than he expected it to be. This year the losses on distribution were 28·7 per cent. instead of 26·2 per cent. He looked on the whole position of the company as being exceedingly satisfactory. The whole of their plant was now modern, and was, he believed, to-day worth every shilling they had

expended on it. So far as they could see, there would not be any large capital expenditure in the future, and they hoped to be able to meet such expenditure out of the reserves they were creating each year. Happily, they had not now to spend large sums as in years past in fighting rivals. The London County Council had appointed a Committee, which sat last year, with a view to considering what course they would take with regard to the electric lighting undertakings, and he had reason to believe that the Committee would be reconstituted. Whether the Committee would take any steps which would imperil their position he did not know, but, speaking for himself, he looked forward without the slightest fear to the future so far as that company was concerned. They were actually supplying 20,000 H.P. for machinery, which showed that whatever might be said as to the want of cheap electricity, it was not a charge which could be sustained against them. In conclusion, the chairman invited the shareholders to assist the company by pushing the merits of electrical appliances, and said he could not sit down without expressing the appreciation of the board to their officers and staff for the zealous help they had given in the past year.

Mr. J. M. Gatti seconded the motion, and the report was adopted without discussion.

The retiring directors were re-elected, and a hearty vote of thanks was accorded to the board and staff.

STOCKS AND SHARES.

Tuesday Evening.

The expectation that Turkey would make peace through the mediation of the Great Powers was a useful factor in strengthening markets throughout the Stock Exchange. The chief reason for the relief felt at this prospect lies less in the anticipation of hostilities ceasing than in that of money becoming easier immediately the war has spent itself. The money which has been hoarded up during the Balkans affair will, it is supposed, be released, and on the hope of this there was a general recovery throughout the House.

The Home Railway market, however, provided the damper for the spirits of the bulls. This week's meetings of railway-men were not encouraging to the confidence of those who had looked forward to a strike being averted, and up to the time of writing on Tuesday evening, the possibility of a struggle is certainly present. This has had a depressing effect upon prices, which just before had started to recover, on the theory that the March figures would look bumper ones in comparison with those of the corresponding period 1st year, during which the coal strike was in full blast. It looks now as though strike figures might compare with strike figures, although, so far, it must be admitted that hopes of a possible solution of the difficulties are far from dead.

Metropolitans have been up to 53½, but dropped to 51¾, leaving off with a net fall of ¼ on the week. Districts, in which there has been a sharp rise, reacted to 38¾, at which they still show an improvement, while the Underground Electric Railways group is firm. The speech of Sir Edgar Speyer at the meeting of the Underground Company last week infused fresh courage into the minds of holders, who had been rather disappointed with the character of the company's report, for Sir Edgar hinted at the prospect of a dividend being nearer than might have been supposed from the report itself. The 6 per cent. Income bonds at 94, *ex* £3 coupon, show a rise of 2—in their case the coupon is paid without deduction of income-tax. The £10 shares rose ⅛, but lost it again, and the "A" are somewhat weaker than might appear from the official quotation.

Central London Ordinary and Deferred have come into some prominence on the consideration that the stocks are cheap at the present yields. The dividend is guaranteed at 4 per cent. in the case of the Central London trio, and, accordingly, is so worked out in our lists overleaf. City and South London Preferences have again fallen sharply, the 1903 issue being down to 96½, at which the yield is £5 2s. per cent. on the money, this being about the highest return obtainable from sound stock in the railway preference division. London United Trams have not recovered from their last week's fall, and the British Electric Traction sextet remains dull.

The list of English Electricity Supply shares is once more a colourless one. Dividends have been deducted from Westminster Ordinary, St. James's Ordinary and Preference, and South Metropolitan Preference, the markings being reflected in the prices. City Lights fell ½ on the issue of the report, good though it is. The County of London report makes a very favourable showing, while that from the Chelsea Company is very like its predecessor of a year ago, the net result being almost the same in each case. The reports which have been published so far make a satisfactory appearance on the whole, but they are not sufficiently exciting to prove of themselves strong enough magnets to arrest the attention of the ordinary investor, who retains a lively recollection of the fact that within some vague number of years the companies will be taken over. He is not aware that it is to 1931 that most of the concessions run, but the mere fact of their having a term at all is his ground for letting the market alone.

The recovery in Mexican issues has made further progress this week. The main change is a rise of 4 points in Mexico Trams Common, but Mexican Light and Power Common gained 3, and the First Gold bonds advanced 2. Montereys provided the exception, with a fall of a point to 83½. The news from the country is read as showing that there is a strong man in power, who, if he can avoid assassination and similar little excursions inseparable from the life of a president in Mexico, may be able to restore order with a firm hand.

Other stocks and shares in this department are steady. Montreals shed 3 points, but Shawinigans rose this amount, the bonds putting on ½. Brazilian Traction Ordinary, at 101, are 3 points higher, and one or two of the British Columbia emissions have small rises to their credit. La Platas are a little easier, and Victoria Falls Preference, at ⅞, have gone back another $\frac{1}{32}$ per share. The Anglo-Argentine group is steady, and City of Buenos Ayres Trams recovered part of their dividend deduction.

The Telegraph market shows a series of small rises, which has included the pre-ordinary stocks as well as the junior securities. The improvements are noticeable in the Anglo-American group and in the Eastern section. West India and Panamas are a little better on relaxation of the monetary tension, the price regaining 2s. 6d. of its fall. Globe shares, both Ordinary and Preference, are ½ up; but Mackay Common fell back to 84½. It may be noticed that Reuter's new shares have been added to our list of Telegraph and Telephone prices. The market now is largely in these new shares, which stand a trifle under their seniors, the discrepancy being accounted for by the fact that up to June 30th they carry a little less dividend than the others.

Business in National Telephone Deferred stock has come to something like a stop, now that the Company's books are finally closed. Nobody can tell how long it will be before the final settlement of the transfer will take place. Some fix it as six months, but the estimates are little better than guesswork. Marconi's fell back to 4¼, and the subsidiary companies' shares are mostly a trifle lower, the market, for some reason or other, being a bad one at present. It is said that a new issue may be made by the Cuban Telephone Company.

In the Manufacturing division, General Electric Preference are nominally a little better, while Edison & Swan partly-paid shares have moved up to 5s. middle, following their last week's rise of $\frac{1}{16}$ with another of equal amount. British Westinghouse Preference are somewhat easier. The Rubber share market is weak, with the price of the raw material gradually dwindling. Its decline to 3s. 10½d. per lb. has given rise to uneasy sentiments in the minds of some of the rubber share holders, although there is no pressure to sell good shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £	Receipts for the month. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Bath	Feb. 26	2,669	+ 27	9	6,289	+ 230	..	..
Blackpool-Fleetw'd	Mar. 1	1,124	- 65	9	2,300	— 5	8	..
Bristol	Feb. 28	26,490	+ 2,456	9	56,702	+ 4,523	30·5	..
‡Brit. Elec. Trac. Co.	„ 21	88,807	+ 5,358	8	154,968	+ 9,408	..	..
Chatham and Dist.	„ 20	3,175	+ 259	7	5,984	+ 268	14·98	..
Cork	„ 27	1,678	+ 7	8	3,556	— 90	9·89	..
Dublin	„ 28	21,165	+ 630	8	45,765	+ 1,663	54·25	..
Hastings	„ 27	2,748	— 18	..	..	+ 58	19·3	..
Lancashire United	„ 26	5,262	+ 404	8	10,763	+ 736	39	..
Llandudno-Col. Bay	„ 28	612	+ 88	13	1,934	+ 170	6·5	..
London United ..	Mar. 1	20,661	— 785	9	47,812	— 81	..	..
Tyneside	Feb. 26	1,898	+ 243	9	3,607	- 118	11	..
Anglo-Argentine ..	„ 25	218,565	+ 15,614	8	437,775	+ 35,310	..	..
Auckland	Jan. 17	21,653	+ 1,883	29	159,412	+ 20,118	24·1	·8
Bombay (B.E.T.) ..	„ 30	12,643	+ 198	5	13,551	+ 192	..	..
Brisbane	Dec.	25,890	+ 1,660	52	254,911	+ 2,211	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Mar. 1	16,717	+ 867	..	..	+ 449	..	..
Cape Electric T. Ltd.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A. ..	Jan.	2,734	..	4	2,724	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
Madras	Feb. 28	3,163	+ 188	8	6,706	+ 5,451	14·7	2
Montevideo ..	Jan.	38,661	+ 3,010	13	102,167	+ 11,355	..	..
Cen. London Rly.	Mar. 1	21,565	+ 1,421	9	49,565	3,660	6·78	·4
City & S. Lon. Rly.	„ 1	12,053	— 1,397	9	27,610	— 3,086	7·26	..
†Dublin-Lucan Rly.	Feb. 28	329	+ 27	9	941	+ 16	7	..
G.N. and City Rly.	Mar. 1	6,174	— 769	9	14,003	— 1,722	3·5	..
L'pool Overh'd Rly.	„ 2	6,235	+ 962	9	14,323	+ 1,001	6·6	..
London Elec. Ry. Co.	„ 1	67,860	— 1,195	9	133,100	— 1,560	21·25	..
Mersey Railway ..	„ 1	9,070	+ 428	9	20,289	+ 1,081	4·5	..
Metropolitan Rly.	„ 2	64,653	+ 387	9	148,787	— 1,945	25·75	..
Met. District Rly.	„ 1	52,399	+ 1,148	9	119,312	+ 4,493	25	..

* Compared with the corresponding period of 1912.
† Three weeks only.
‡ Includes horse, steam and other receipts.

The Bradford Strike.—A Bradford correspondent writes:—"The strike of Bradford electricians still continues, although this is the end of the twentieth week of the strike, and there is no immediate prospect of a settlement. Most of the contractors in the city have got staffs of non-union men working, and a lot of the strikers have been driven to take up other jobs, so that there is little likelihood of any further negotiations between the masters and men. There is an impression that the men were very ill advised by their leaders at the commencement of the trouble, and the Trade Union organiser left the district some time ago."

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Mar. 4th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5⅛	5†	9⅛ — 10⅛	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9⅜	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	9⅞ — 10¼	..	5 17 1
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord...	5	10	9†	8⅞ — 9⅛	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City Do. 4½ % Cum. Pref... ..	5	5	5†	4⅛ — 5	..	5 0 0
Do. " City Undertaking " 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. Do. 4 % Deb... ..	100	4	4	3⅞ — 4⅛	..	5 2 10
Chelsea, Ord.	5	4	4	91⅛ — 93½	— ⅛	4 5 7
Do. 4½ % Deb.	Stock	4½	4½	4⅜ — 5⅛	..	4 15 3
City of London, Ord.	10	8	9	96 — 99	..	4 10 11
Do. 6 % Cum. Pref.	10	6	6	16½ — 18	— ½	5 0 0
Do. 5 % Deb.	Stock	5	5	12½ — 13⅝	..	4 9 0
Do. 4½ % Second Deb. ..	100	4½	4½	116 —120	..	4 3 4
County of London, Ord... ..	10	6	6	100 —102	..	4 8 3
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 12 9
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 4 11
Edmundson's, Ord.	£3	Nil	..	⅝ — 1 1/16	..	4 8 3
Do. 6 % Cum. Pref.	5	Nil	3	4¼ — 4⅝	..	Nil
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅜ — 1⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	81 — 84	—1	5 7 2
Folkestone	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	8†	7⅞ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7⅞ — 8¼	..	5 9 1
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅛ — 2	..	3 15 0
Do. 6 % Pref.	5	6	6	4⅜ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	+1	4 6 0
Metropolitan	5	4	4†	3½ — 4	..	5 0 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	84 — 86	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 —101	..	4 9 1
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99½ —102½	..	4 17 7
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅜	..	5 11 7
Oxford	5	7½	6†	6⅛ — 6⅜	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	8⅜ — 9¼ xd	..	5 8 1
Do. 7 % Pref.	5	7	7	6¾ — 7⅜ xd	..	4 15 0
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	2	2	⅜ — 1½	..	..
South London, Ord.	4	5	..	2⅜ — 3½	..	6 3 1
Do. 5 % First Mort. Deb. ..	100	5	5	97 —100	..	5 0 0
South Metropolitan, 7 % Pref...	1	7	7	1 3/32 — 1 7/32 xd	..	5 14 10
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 3
Urban, Ord...	£3	Nil	..	¼ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅜ — 3½	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84½ — 87½	..	5 2 10
Westminster, Ord.	5	10	10	8½ — 9 xd	..	5 11 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	4⅞ — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5¼xd	..	5 14 3
Calcutta, Ord.	5	8½	7†	6⅜ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛ xd	+1/16	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	92 — 94	..	5 6 5
Canadian Gen. El. Com. ..	$100	7	7	115 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	8	5	13/16 — 15/16	..	5 6 8
Do. 5 % Deb.	100	5	5	96 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95 xd	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	9/16 — 11/16	..	9 15 2
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101⅛ —103½	..	4 16 7
Madras, Ord.	5	Nil	..	1⅜ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	83 — 86	+ ⅜	5 16 3
Mexican Lt. & Power, Common	$100	4	4†	81 — 83	+3	4 16 5
Do. 7 % Cum. Pref.	$100	7	7	101 —105	+ ½	6 13 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 96½	+2	5 3 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	82 — 85	—1	5 17 8
Montreal, Lt., H. and Power ..	$100	8	9†	230 —235	—3	3 16 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	217 —227	..	4 8
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	104 —109	..	5 10 1
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5	141 —145	+ 3	3 9 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106½ —108½	+ ½	4 12 2
Do. 4½ % Per. Deb. Stock ..	Stock	4½	4½	101—103	+ ½	4 7 5
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	98½ —100½	..	4 9 7
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅞d.	13/16 — 15/16	—3/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105 —107 xd	+ 2	5 12 2

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 — 7⅞	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	— ½	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	135½ —137½	+1	5 16 5
Do. Collat. Trust	$1000	4	4	91 — 93	..	4 6 0
Anglo-American Telegraph ..	Stock	8	8	65½ — 67½	— ½	4 9 0
Do. 6 % Pref.	Do.	6	6	111 —112	+ ½	5 7 2
Do. Def.	Do.	80/-	..	24 7/16 — 24 15/16	+ 1/16	6 1 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	99½ —101⅛ xd	..	4 18 6
Chili Telephone	5	7	8	7⅜ — 7⅞	..	5 1 7
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	79 — 81	..	4 18 9
Cuba Telegraph	10	6	6†	8⅜ — 9½	..	6 9 9
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	8⅛ — 8⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅞ — 6⅞	..	7 8 2
Direct United States Cable ..	10	5	4	6⅝ — 7⅛	..	6 15 7
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	134 —137	+ 1	5 2 2
Do. 8½ % Pref. Stock.. ..	Do.	8½	8½	78⅝ — 80⅝	+ ⅛	4 6 11
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7†	13 — 13⅛	+ ⅛	5 3 8
Do. 4 % Deb.	Stock	4	4	95 — 97	— ½	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 8
Globe Telegraph and Trust ..	10	6	6†	10⅝ — 11⅛	+ ⅛	5 7 10
Do. 6 % Pref.	10	6	6	12⅛ — 13	+ ⅛	4 12 4
Great Northern Telegraph ..	10	18	18	29 — 31	..	5 14 3
Indo-European Telegraph ..	25	18	5†	57½ — 59½	+ ½	5 9 8
Mackay Companies Common ..	100	5	5	83 — 86	—1	5 16 3
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	4 5/16 — 4 7/16	— ⅛	4 12 10
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅝ — 3⅞	— ⅛	4 10 8
Monte Video Telephone, Ord...	1	6	6†	1⅝ — 1 1/16	..	5 13 0
Do. 5 % Pref.	1	5	5	3/8 — 7/8	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98 — 99	— ½	4 10 11
Oriental Telep. and Elec. ..	1	8	6†	1⅞ — 1 15/16	+ 1/32	4 9 10
Do. 6 % Cum. Pref.	1	6	6	1 3/32 — 1 7/32	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ — 99½	..	4 0 5
Reuter's	10	10	10†	11⅛ — 11⅜	..	8 10 2
Do. New Shares	10	..	..	10 15/16 — 11 1/16	..	..
Submarine Cables Trust ..	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	+	4 12 9
United River Plate Telephone	5	8	..	7⅜ — 7⅝	+ 1/16	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1⅛ — 1⅜	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	95 — 98	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	3⅛ — 3⅜	+ ⅛	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	13⅜ — 13⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	95 — 97	..	4 2 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97½ —100½	..	4 10 0

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Mar. 4th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	—	..	Nil
Do. 5 % Pref.	1	5	5	—	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	10½ — 12½	..	..
Do. Do. Deferred	100	..	..	4½ — 6½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85½ — 88½	..	6 16 7
Do. 7 % Non-Cum. Pr'f.	100	..	..	35 — 38	— ½	..
Do. 5 % Perp. Deb.	100	5	5	91 — 95	..	5 5 3
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	8	8	79 — 81	—1	4 18 9
Do. Pref.	100	4	4	83 — 85	..	4 14 2
Do. Def.	100	2	2	79 — 81	..	4 18 9
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
City & S. London, 5 % Pref., 1891	100	5	5	99 —102	—1	4 18 0
Do. Do. 1896	100	5	5	99 —102	—1	4 18 0
Do. Do. 1901	100	5	5	97 —100	—1	5 0 0
Do. Do. 1908	100	5	5	95 — 98	—3	5 2 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	11⅜ — 12⅝	..	4 18 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅜ — 2⅝	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	—	..	7 7 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	78 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	4⅞ — 5	..	..
Do. 4 % Deb.	100	4	4	68 — 71	..	5 12 8

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Mar. 4th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	* 100	1⅝	1⅝	51½ — 52	— ½	3 2 6
Do. Surplus Lands	100	2⅝	2½†	61 — 63	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	84 — 86	..	4 1 5
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	81 — 83	..	4 4 4
Metropolitan District Ord.	100	Nil	Nil	38½ — 39	..	Nil
Do. 6 % Deb.	100	6	6	135 —137	..	4 7 7
Do. 4 % Deb.	100	4	4	93 — 95	..	4 2 6
Do. 4 % Prior Lien	100	4	4	98 —100	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	85 — 87	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	5†	—	..	5 18 6
Do. 5 % Pref.	1	5	5	—	..	5 14 3
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	3½	..	—	..	..
Do. 5 % Pref.	1	5	5	—	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 3
South Metro. Trams, 6 % Pref.	1	6	..	—	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4⅜ — 4⅝	..	Nil
Do. "A"	1/-	..	..	—	..	..
Do. 6% First Cum. Inc. Deb.	100	..	6	110 —112 xd	+1½	5 7 2
Do. 4½ % Bonds	100	4½	4½	98 —100	+3½	4 10 0
Do. 6 % Income	100	1½	6 †	93 — 94 xd	+1½	6 7 8
Yorkshire (West Riding), Ord.	5	Nil	..	—	..	Nil
Do. 6 % Pref.	5	3	3†	2⅜ — 3⅝	..	4 12 4
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5⅜	5⅜	4 3/16 — 4 5/16	..	5 14 8
Do. 4 % Deb.	100	4	4	92 — 94	— ½	4 5 1
Do. 4½ % Deb.	100	4½	4½	98½ —100½	..	4 9 7
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	100 —102	+3	..
Brisbane Trams Invt., Ord.	5	8	8†	7⅛ — 7⅝	..	5 5 0
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	..	139 —143	..	5 12 0
Do. Pref. Ord.	100	6	6	119 —123	..	4 17 7
Do. 5 % Pref.	100	5	5	106 —109	+1	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101⅜ —103	..	4 7 5
Do. 4½ % Con. Deb.	100	4½	4½	97 — 99	+ ½	4 5 10
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛	..	5 12 0
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Cape Electric Trams	1	2½	..	—	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 7/16 — 5 9/16 xd	..	4 8 0
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	—	..	Nil
Do. 5 % A Deb.	100	5	5	88 — 88	..	5 18 8
Do. 6 % B Deb.	100	6	3	25 — 35	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	—	+1/32	..
Do. Pref.	1	6	..	—	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	—	..	4 7 3
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	92 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 90	..	5 11 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	110 —113	+4	6 4 0
Do. Gen. Con. 5 % Bonds	..	5	5	91 — 95 xd	+1½	5 5 3
Do. 5 % Bonds	100	5	5	97½ —100½	— ½	5 19 5
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7⅜ — 7½	..	6 7 0
Do. 6 % Pref.	5	6	6	4¼ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅜ — 1½	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 —103	..	4 17 1
Do. 5 % Mort. Bonds	100	5	5	96 — 98	..	5 2 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	103 —105	— ⅓	4 15 3
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video	5	7	6†	5⅛ — 5⅜	..	6 1 9
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98 —101	—1	4 19 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	—	..	8 0 0
Do. 6 % Pref.	1	6	6	—	..	7 2 2
Babcock & Wilcox	1	28	14†	—	..	4 0 0
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
British Aluminium, Ord.	1	Nil	..	—	..	..
Do. 6 % Cum. Pref.	1	Nil	..	—	..	..
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	..	5 6 5
Do. Deb. Stk.	100	5	5	87 — 90	..	5 11 1
B.I. & Helsby Cables	5	10	8†	8⅛ — 8⅜	..	5 15 11
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94½ — 96½	..	4 13 6
British Westinghouse, Pref.	8	Nil	Nil	—	— 1/16	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	9	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	88 — 43 xd	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	28 — 32	..	14 1 4
Callender's Cable	5	15	10†	11 — 11⅜	..	6 7 8
Do. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	20	31⅛ — 31⅜	..	5 5 0
Do. Deb.	100	4½	4½	103 —106	..	4 4 11

Crompton & Co.	8	Nil	..	—	..	Nil
Do. Deb.	100	5	5	55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	—	..	..
Do. Pref.	1	6	6	—	..	6 17 2
Do. Deb.	100	4½	4½	96 — 98	..	4 11 10
Edison & Swan, A, £8 paid	5	Nil	..	—	+1/16	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	61 — 66	..	6 3 1
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3½	1⅜ — 1 7/16	..	5 14 4
Do. Pref.	2	7	7	2 — 2⅛	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅝ — 8	..	8 8 8
Do. Deb.	100	5	5	92 — 94	..	5 4 3
General Electric, Pref.	10	5	5	10 — 10⅜	+ ⅛	4 13 0
Do. Deb.	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	13 — 13⅜	..	6 8 3
Do. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11	..	6 16 4
Do. Pref.	10	5	5	9⅛ — 10⅛	..	4 17
Telegraph Construction	12	17½	5†	86 — 88	..	5 16 8
Do. Deb.	100	4	4	95½ — 98½	..	4 1 3
Willans & Robinson	1	Nil	..	—	..	Nil
Do. Pref.	5	Nil	..	—	..	Nil
Do. Deb.	100	4	4	57 — 59	..	6 15 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 5 per cent., October 17th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JANUARY, 1913.

THE returns of electrical business during January, which we publish herewith, show a considerable advance over the figures for the last month of 1912.

The exports reached a total value of £576,526, as compared with £510,700 in December last, and included very large amounts due to machinery and cables, the former reaching over £212,000 in value, and the latter nearly £114,000.

The imports totalled £252,167, as compared with £231,554 in the preceding month, while the re-exports amounted to £28,494, as compared with £24,867 in December.

The exports from this country showed a general improvement over those of the preceding month, and although they included £81,713 worth of telegraphic material—an amount rather above the average—the remaining business, totalling £494,813, was only once exceeded in value during 1912. Brazil, India, New South Wales and Argentina were our best customers during the month, the former owing its unusually prominent position to a telegraphic purchase valued at £45,000. Machinery and cable imports were both at a considerably higher level than in December—the imports total of £252,167 comparing with an average of about £217,000 per month during 1912.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,743	400	70	184	...	534	8,090	658	127	24	506	7,315	19,651
Germany	2,572	78	63	43	573	...	3,483	...	48	...	84	157	7,101
Netherlands, Java & Dutch Indies	833	2,254	191	...	31	...	1,541	11	11	8	89	488	5,457
Belgium	733	252	409	117	137	207	1,907	2,673	11	54	1,338	306	8,144
France	1,194	...	3,881	73	13	23	11,569	796	40	13	104	385	18,091
Portugal	282	141	16	61	...	...	782	...	...	...	130	237	1,649
Spain, Canary Isles and Spanish N. Africa...	2,065	3,221	382	...	...	329	7,289	572	22	...	561	762	15,203
Switzerland, Italy and Austria-Hungary ...	616	32	55	...	...	23	3,521	15	60	871	245	3,699	9,137
Greece, Roumania and Turkey	87	399	68	200	22	...	134	...	...	...	1,869	38	2,817
Channel Isles, Gibraltar, Malta and Cyprus...	62	341	24	44	...	26	459	...	11	...	...	3,820	4,787
U.S.A., Philippines and Cuba	194	46	...	...	...	347	442	...	233	...	...	...	1,262
Canada and Newfoundland	535	3,158	708	914	...	1,080	23,305	...	6,181	...	221	828	36,930
British West Indies and British Guiana ...	118	...	126	26	...	...	106	...	11	10	130	50	577
Mexico and Central America	31	22	66	...	...	...	207	...	18	...	...	...	344
Peru and Uruguay	481	132	9	15	106	5	479	...	68	...	4	608	1,907
Chile	387	434	331	129	...	75	3,159	31	228	...	179	350	5,303
Brazil	1,367	903	854	321	42	43	8,747	1,454	359	56	7,954	45,021	67,121
Argentina	3,316	14,578	1,863	1,077	219	358	14,062	2,872	995	227	5,124	547	45,238
Colombia, Venezuela, Ecuador and Bolivia...	177	...	74	273	...	...	1,832	...	105	...	70	...	2,531
Egypt, Tunis and Morocco	473	236	429	73	14	...	1,644	...	278	...	152	567	3,866
British West Africa	255	822	142	37	11	58	807	...	15	...	63	440	2,650
Rhodesia, O.R.C. and Transvaal	2,372	5,183	177	612	...	36	6,021	17	80	3	48	206	14,755
Cape of Good Hope	2,042	5,099	584	928	13	505	11,625	36	4,854	21	7,784	1,118	34,609
Natal	1,348	6,255	550	478	...	313	1,224	...	35	3	448	117	10,771
Zanzibar, Brit. E. Africa, Mauritius & Aden	70	...	34	108	...	36	679	...	14	...	61	215	1,217
Azores, Madeira and Portuguese Africa ...	246	465	197	44	...	36	2,596	21	19	...	...	255	3,879
China and Siam	2,575	736	860	1,716	28	1,984	2,762	...	1,064	...	90	4	11,819
Japan and Korea	875	3,685	308	16	115	1,059	22,582	1,273	546	150	333	...	30,942
India	3,727	12,277	2,540	2,213	326	1,044	16,848	2,700	5,550	233	1,917	1,239	50,614
Ceylon	372	2,613	36	202	...	126	518	860	64	...	715	37	5,543
Straits Settlements, Federated Malay States and Sarawak	462	1,534	166	9	...	500	1,778	207	31	147	1,241	63	6,138
Hong Kong	786	440	579	183	...	176	993	29	289	...	...	24	3,499
West Australia	551	579	213	228	...	563	3,007	112	1,200	...	1,589	1,254	9,296
South Australia	758	6,144	147	470	...	733	1,250	66	36	...	3,526	9,880	23,010
Victoria	2,818	17,005	1,896	844	...	284	5,269	260	1,153	...	3,291	218	33,038
New South Wales	3,354	18,999	1,310	1,270	...	735	9,439	2,023	79	5	7,406	800	45,420
Queensland	469	2,567	38	261	...	130	2,170	...	86	46	4,997	100	10,864
Tasmania	59	...	6	...	11	320	62	...	23	...	249	...	730
New Zealand and Fiji Islands	772	2,680	578	262	528	54	13,350	...	219	25	1,583	565	20,616
Total, £	41,177	113,710	19,980	13,431	2,189	11,742	195,738	16,686	24,163	1,896	54,101	81,713	576,526

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark	49	...	7	118	...	36	7,047	308	409	...	5,732	13,706
Germany	10,089	28,129	1,359	15,286	8,555	3,096	63,431	1,427	3,703	7,526	11,971	154,572
Holland	150	...	...	2,235	735	...	109	...	10	...	...	3,239
Belgium	712	2,738	344	407	135	24	2,560	21	281	93	6,902	14,217
France	97	6	1,125	958	227	2,014	2,372	...	598	3,766	1,488	12,651
Switzerland	312	824	93	119	18	337	1,207	...	17	323	4	3,254
Italy	326	4,735	60	...	...	...	170	...	...	...	29	5,320
Austria-Hungary	...	1,305	...	1,135	283	...	225	...	12	981	10	3,951
United States	3,453	995	992	43	708	15	9,422	21,739	317	256	146	38,086
Total, £	15,188	38,732	3,980	20,301	10,661	5,522	86,543	23,495	5,347	12,945	26,282	248,996

Additional imports: Spain, carbons, £197; Greece, machinery, £90; Canada, telegraphic goods, £2,884.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	10,891	1,032	...	3,234	1,747	...	9,185	...	459	788	1,158	28,494

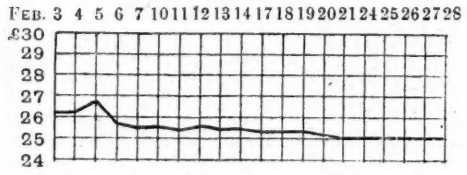
TOTAL EXPORTS: £576,526. TOTAL RE-EXPORTS: £28,494. TOTAL IMPORTS: £252,167.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

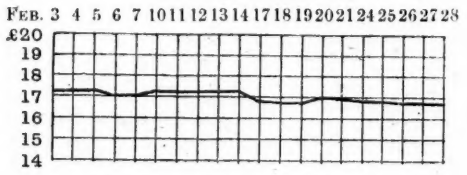
METAL MARKET.

Fluctuations in February.

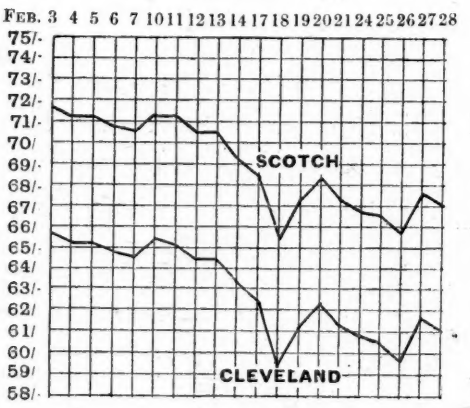
SPELTER (G.O.B's.).



LEAD (ENGLISH).



IRON.



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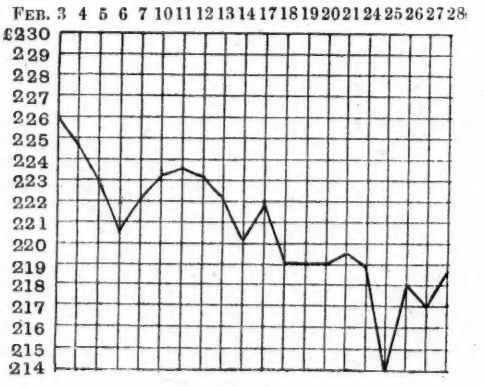
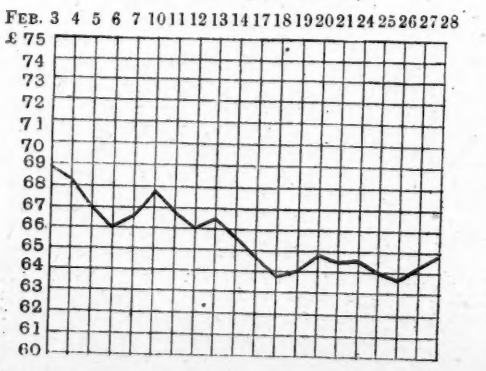


COPPER (G.M.B's.).



A PLEA FOR THE DOMESTIC LOAD.

By "WHISTLEFIELD."

Electricity undertakings have lately wakened up to the need of pushing for business and trusting less to Providence to send along new consumers. The convenience and utility of the electric motor, even in inexperienced hands, have led to a great increase in the output of electricity for power purposes of undertakings situated in industrial areas, and the result of this day load has been an improvement in the load factor, with a consequent reduction in the cost of generation, to the mutual advantage of the undertaking and the consumer. Recently, however, engineers have begun to realise that a day load does not necessarily mean a motor load only, because electrically heated and operated appliances are being put on the market which can be relied on to do useful work without continually breaking down, and which can also be purchased at a reasonable cost.

The operation of these appliances will be found to increase the much-desired day load, since most housework is done in the forenoon, and, in any case, only a small proportion of houses are wired for plugs so that connection can be obtained only by removing a lamp and using an adaptor. Even in the case of radiators, kettles, toasters, &c., which are used during the hours of heavy lighting load, the fact that their use is intermittent and for short periods only, prevents the peak load from being appreciably affected, for the chances of a large number of, say, kettles or hot plates being "on" at identically the same time are very remote.

Engineers who are striving for a better load factor do not, however, appear to realise the importance of encouraging the use of the *smaller* domestic appliances, quite overlooking the fact that although they may be used for a short period only each day they nevertheless take a fairly high current compared with lamps, and so can be relied on to appreciably increase the units used from any service without increasing the capital expenditure in distribution.

To put a new service in a small shop, whose average load will probably not exceed six 55-watt metal-filament lamps, will cost approximately £5, including meter and other charges. Such an installation, as the examination of ledgers clearly proves, uses between 250 units and 500 units per annum, depending on the nature of the business, while the average for small dwelling houses comes to about 250 units per annum. A large proportion of the units used on such installations are taken at times of heavy lighting load, so that each installation connected means not only an increase in the capital expenditure on mains but also on plant.

The use of small domestic appliances, however, like irons, kettles, &c., requires no extra expenditure to install them, as far as the supply authority is concerned, and increases the units used from existing services by as much as 10 per cent. to 30 per cent. Even undertakings which have a good power load could profitably develop a domestic load, for power loads usually overlap the lighting load in winter, and plant must be provided for this overlapping, so that the domestic load helps to utilise the surplus plant not required during the day for power purposes.

Some undertakings, realising the advantage of a domestic load, have commenced to hire out electric cookers, but, so far, it is uphill work; people are not quite convinced yet that cookers are reliable, and they are not prepared to put in a special circuit for the cooker, or to run the risk of being left without food through a blown fuse or a defect in the apparatus, though they may be quite convinced of the advantages of electric cooking. This method also involves heavy capital expenditure to the undertaking for comparatively small returns.

The following method tried by some other undertakings seems to promise more success, since the capital expenditure involved is small and the returns are fairly large. A number of 6-lb. flat irons fitted with 3 yards of flexible, and terminating in an adapter, are loaned to consumers on the distinct understanding that no liability of any kind is incurred by their use. Since there is no preliminary expense for alteration to wiring, or liability for damage to apparatus, the consumer will have every inducement to give the iron a trial, and if there are

any babies or grown-up daughters in the house, that iron will be in use on an average at least half an hour per day. The convenience of merely turning on the switch to heat the iron makes people put it on for doing the smallest article, and as it takes about five minutes to heat up, and may be in actual use only five or ten minutes more, the number of times the iron is heated up accounts for quite an appreciable number of units.

At the end of five or six weeks, when the iron is taken away to be loaned elsewhere, the contrast between the old method and the new will be so great that the household will find that it cannot get on without an electric iron. If the supply authority has powers to supply apparatus on hire, or hire-purchase, a good business can now be done, not only in irons, but also in other current-consuming devices due to the favourable impression made by the iron. If the undertaking cannot hire apparatus, arrangements should be made with a good local firm to stock a quantity of irons identical with those sent out on loan. A good iron, complete with flexible and adapter, can be bought wholesale for about 7s. 6d., so that for the same expenditure as on a new service 15 irons can be put out on loan. Assuming that each iron is switched on only for three hours a week, a very moderate estimate, each iron will account for 63 units in the year, and the whole 15 will increase the annual output by nearly 1,000 units, units which are used during the day, and, therefore, at times of light load, and most of which will have been paid for at lighting rates while the irons were on loan.

A good electrical cooking outfit will cost complete about £15; this sum spent on smaller apparatus, such as irons, would be able to purchase 45, which, on the above basis, would cause a consumption of about 3,000 units per annum, a return far greater than that which a single cooker would cause, besides which the irons will have done six weeks of canvassing work in 360 households, and probably caused another 200 irons, involving an annual consumption of 12,000 units, to be connected to the mains.

When lending out irons, small shops should not be neglected, for in many of these the proprietress or her daughters will bring down their work and do it in the back shop during slack times.

After the possibilities of an ironing load have been exhausted, the same procedure can be adopted with electric kettles. Even if a kettle is used only twice a day for ten minutes each time, at breakfast and tea, for keeping a supply of hot water available, it will consume two units a week or 100 units per annum, so that a household with a 2-pint kettle and iron will use at least 150 units more per annum than before; this is not a great quantity, but it very often represents a 50 per cent. increase in the units supplied through the service without any appreciable increase in the maximum demand at times of peak load from that service.

These are only two of the many small, and, therefore, comparatively cheap domestic appliances which can be judiciously pushed amongst electricity consumers, and the figures quoted give some indication of the percentage by which the output from any undertaking could be increased. Great care, however, must be exercised in choosing the apparatus which is circulated, as bad design, resulting in continuous breakdown, will do a great deal of harm, which will take a long time to neutralise. To make the use of electrically operated domestic appliances popular, the prices charged for the energy used must be made reasonable; there are several methods of doing this. One is to make a special charge for all units used for domestic purposes other than for lighting or power; this is almost out of the question if it means a separate meter, and, therefore, a separate circuit throughout the house; the additional expense in fitting up the installation would probably kill the movement at once.

The only method of charge which seems to meet the case is the "telephone" or "annual charge" system, by which a fixed sum is paid each quarter, and all units used on the premises are charged at a low rate, ranging from 1d. to ½d. per unit.

The methods adopted by different undertakings for arriving at this fixed charge vary a great deal; some make the charge a percentage of the rateable value, others base the charge on the maximum demand, while others, again, base their charge on the floor space. Since the ideal arrangement would be to charge for all units used for lighting at the lighting rate, and all units used for domestic purposes at the special low rate, without, however, the drawbacks and expense of two separate circuits, the annual charge must be fixed at such a figure that, if electricity were used for lighting only, the bill would come to the same amount on either the flat rate or the annual charge rate; then every extra unit used, presumably for domestic purposes, would actually be obtained at the low rate.

For example, if, in a certain case, the lighting bill per annum averaged £3 with energy at 3d. per unit, it follows that the units used per annum must have averaged 240. If the annual charge in this case were fixed at £2, and all units used were charged at 1d. per unit, then the annual consumption of 240 units on this system would work out at £3, the same as on the flat rate; but if, in addition to using the 240 units for lighting, 150 units had been used for heating purposes also, the bill would work out as follows:—

Annual charge	£2	0	0
390 units at 1d. per unit	1	12	6
Total ...	£3	12	6

which is exactly the figure which would have been arrived at if the units had been registered on separate circuits, that is, 240 units at 3d. = £3, and 150 units at 1d. = 12s. 6d., total £3 12s. 6d. Of course it is not advisable to base the annual charge for any installation on the units actually used on that installation, because there may have been abnormal conditions prevailing; also, it would lead to such anomalies as two identical houses being charged annual sums of different values. The correct and only safe way is to collect the data relating to houses of the same size and strike an average; all the figures obtained can be compared, and, where necessary, graded so as to obtain an equitable scale.

Such a scale can be easily explained to consumers, and as it is perfectly straightforward without any electrical terms by which he may be trapped later, there is no difficulty in inducing a consumer to go on to this system of charging when domestic appliances are installed.

Undertakings with a good motor load can afford to neglect this kind of day load, but undertakings situated in residential districts will find, if they go into the matter carefully, that in the development of the domestic load they have the means whereby they can appreciably increase their load factor, and thus considerably reduce the cost of production.

THE USE OF ELECTRICITY AND ELECTRICAL ACCIDENTS IN MINES.

(*Concluded from page* 333.)

In the Manchester and Ireland district there was only one non-fatal accident, which occurred on the surface at Hulton Colliery to a turbine generator attendant. In attempting to replace blown-out fuses, not having switched off pressure, he was slightly burned on the face and eyes. He had passed the switch on his way to the fuses. The arrangement of the switch did not meet with the approval of Mr. Nelson, the fuses being on the "live" side of the switch; the position should be reversed.

In the Liverpool and North Wales district the inspector says: "I am pleased to be able to report that another year has passed without any fatal accident due to electricity. There were, however, four non-fatal accidents, one to an electrician while trying to locate a fault in a fan motor with the pressure on, with the result that the armature shorted and his eyes were thereby slightly injured. In another case a shaft sinker, preparatory to testing, made contact with bare wires at the end of a shot-firing cable. The third accident was due to the bursting of a trailing cable connected to a coal-cutting machine. In the remaining case a motor attendant at St. Helen's Colliery received a shock

while lowering a set of tubs down an incline, at the time when the motor of the haulage engine was at rest."

One can scarcely credit that anyone termed an "electrician" would attempt to locate a fault in a motor with "current" on, and in regard to the shaft sinker we must assume that the shots were being fired from a power or lighting cable, a foolish practice, as it would scarcely be possible for him to receive an injury from a shot-firing battery, which ought to be used in every case for shot-firing purposes. But whatever is meant by a cable "bursting"—we presume it fused owing to its not being of sufficient capacity to carry the current. Was this the result of economy or of sheer ignorance?

"At the St. Helen's Colliery, current in the pit is got from a power house on the surface. The system of distribution is three-phase, 2,200 volts pressure, with insulated neutral. Current is taken down the shaft by a double-armoured three-core cable to a distributing station near the pit bottom. From that point it is taken by single-armoured cable along the main roads to sub-stations, and after being transformed down to 440 is conducted by unarmoured cables to the various motors in the pit. Current at 440 volts was also taken through a small double-pole switch to eight lights arranged four in series. This lighting switch fused and caused a short between two phases, the overload coils in the power station tripped, and so cut off the entire current; but, strangely, the overload cut-outs in the sub-station did not act." There must have been a heavy leak to earth through the cover when the lighting-switch fused, and the shock accident to the attendant was apparently caused through the *earth return to the surface being unable to take the discharge sufficiently rapidly*. Mr. Nelson, H M. Electrical Inspector of Mines, subsequently inspected the plant, and his opinion was that one of the earth connections might have been disconnected at the time of the accident, but made good before the responsible electrician made his investigations.

The italics are ours, but the last statement is amazing, if true. Whoever would break and connect up again the earth connections if not the responsible electrician?

There were two non-fatal underground accidents in the South-Wales district, and three non-fatal accidents on the surface, but of the latter no particulars whatever are given. As regards the two former, in one a "haulier," while harnessing a horse on a double parting, received an electric shock by his head coming into contact with an unarmoured cable carrying 500 volts D.C., the insulation of which was defective. The place was wet, and the water had seriously deteriorated the insulation of the cable. On receiving the shock the haulier fell, and his head struck a tram, causing concussion of the brain. He was unconscious for 45 minutes.

In the other case, a motorman at a hauling engine received an electric shock causing burns to his hand and arm by treading on a wire, the insulation of which was abraded through having been trodden on, while his hand was on a resistance grid. The wire was one of a number between the controller and the resistance grid, which were not properly protected. Pressure 500 volts, three-phase.

One fatal and one non-fatal accident were reported to the inspector by the Midland and Southern district. In the fatal accident, deceased was in charge of a haulage motor. He also had under his control a switch from which cables extended through a ropeway to a 7½-H.P. pump motor, 200 yd. distant. These cables had been in use over 12 years. Originally, they were armoured throughout, but owing to leakages from time to time the armour had been removed in numerous places in varying lengths, from 2 ft. to 10 or 12 yd. apart. The armouring was not earthed, except at two junction boxes which, together with the armouring where they entered the boxes, were earthed in connection with a line of waterpipes. The voltage was 425 D.C. Three days prior to the accident the electrician had tested all sections of the armouring for leakage of current, but said he had found none. The deceased was found lying dead in the ropeway in contact with a strand of wire rope, which was hanging over the electric cables, by a man who attempted to remove him; but he himself received a shock, and therefore went to the motor house and opened the switch, thus shutting off the current. The haulage rope had been respliced on the previous day, and it appeared that someone had carelessly thrown the strand of wire upon the cables in the ropeway to get rid of it. Deceased had authority to travel along the ropeway after shutting off the electric current from the pump motor, but this he neglected to do. Subsequent examination revealed a leakage of current from the cables at the point where deceased met his death. The faulty cables have now been replaced by new ones.

The Inspector goes on to say—and we quite agree with him—that "the accident was very clearly due to inefficient earthing of cable in which the armouring had been cut in a number of places without being bridged over or otherwise rendered electrically continuous." The manager was of opinion that "it is not reasonably practicable to keep the armouring of cables earthed in a haulage road subject to heavy squeeze necessitating heavy repairs over a long period." The answer to this appears to be that if a road is of such a nature that electrical cables cannot be maintained in such a condition as to ensure as far as possible the safety of the workmen, the cables ought not to be there.

Mr. Nelson, H.M. Electrical Inspector of Mines, subsequently visited the colliery, and was of opinion that the supervision and maintenance of the plant had been very inefficient. In his report upon it he stated: " . . . I think it is impossible to come to any other conclusion than that the person in charge of the electrical plant at the mine has either been grossly ignorant of the risk he was allowing the workmen working on the cable level to run, or gravely negligent as regards his responsibility. If the risk in question was also unknown to the management, then it ought not to have been, but, in any event, the conditions which admittedly existed before the accident constitute, in my view, a serious reflection upon those responsible."

The non-fatal accident occurred to a pump-motor attendant at Whitefield Colliery, North Staffordshire, on September 19th. It appeared that the pump had lost its water, and the attendant switched off the current and then switched it on again without placing the controller in the "off" position. The resistance being cut out, there was a flash from the contact, which slightly burned the back of his hand.

SUPPLY TO PREMISES SITUATE OUTSIDE THE "AREA OF SUPPLY."

When the 1909 Act became law, many supply authorities considered that they would benefit themselves and the public by giving a supply to the many premises situate just outside their boundaries. Clause 6 of the 1909 Act reads as follows:—

1. Where it is proved to the satisfaction of the Board of Trade that the occupier of any premises is desirous of obtaining a supply of electricity from any undertakers within whose area of supply those premises are not situate, the Board of Trade may, if the local authority within whose district the premises are situate, and the undertakers (if any) authorised to supply electricity to such premises, consent, by order permit the first-mentioned undertakers to give a supply to those premises on such terms and subject to such conditions as the Board think fit; provided that, if in the opinion of the Board of Trade any consent required by this sub-section is unreasonably withheld, the Board of Trade may proceed as if such consent had been given.

2. An order given by the Board of Trade under this section may, for the purpose of enabling a supply to be given thereunder, confer any such powers and impose any such duties on the undertakers as would have been conferred or imposed by the Electric Lighting Acts and as might have been conferred or imposed by provisional order if the premises and the route along which lines are to be laid for the purpose of giving the supply were within the area of the supply of the undertakers, anything in the special Act or order relating to the undertaking to the contrary notwithstanding.

3. If the undertakers on whom powers are conferred by an order under this section are not a local authority, the works and lines erected and laid under the powers so conferred shall, so long as the order remains in force, be deemed, for the purposes of the provisions as to purchase applicable to the undertaking, to form part of the undertaking within the district of the local authority which comprises the area of supply of the undertakers, or, if that area is comprised within the districts of more than one local authority,

within such of those districts as the Board of Trade may determine.

4. Nothing in this section shall enable the Board of Trade, without the consent of the undertakers within whose area of supply the premises are situate, to give such permission as aforesaid to any undertakers where the last-mentioned undertakers are by any Act of Parliament specifically prohibited from supplying electricity within the area of the first-mentioned undertakers.

For the information of those who have not yet taken advantage of the clause, I will quote the procedure of the Board of Trade in answer to an application lately made.

Having obtained the consent of the local authority, and also the authorised undertakers (a power company), sanction was applied for from the Board of Trade. The Board wrote enclosing a memorandum of procedure, Part "E" of same, reading as follows :—

"*E*."—*Application by undertakers for order of Board of Trade under Sec.* 6 *of the Electric Lighting Act*, 1909. *permitting them to give a supply of electricity to premises situate outside their area of supply* :—

1. The application must be made in respect of specific premises, and not in respect of an addition to the area of supply of the applicants.

2. The application must be accompanied by :—

(*a*) A map or plan on a scale of not less than 6 in. to the mile, having marked thereon, in some distinctive colour, the route of the electric lines proposed to be placed for the purpose of giving the supply, the names of any streets in or along which the said electric lines are to be placed, and the situation of the premises proposed to be supplied.

(*b*) A list of the streets and any railways or tramways proposed to be broken up for the purpose of giving the supply, showing separately those streets (if any) which are not repairable by the local authority, and an affidavit or stamped statutory declaration to the effect that the streets repairable by the local authority are so repairable.

(*c*) Proof of the consent of the local authority in whose district the premises are situate, and of the undertakers (if any) authorised to supply electricity to the premises forming the subject of the application, or evidence that those consents are unreasonably withheld.

(*d*) Evidence that the occupier of the premises to which the application relates is desirous of obtaining a supply of electricity from the applicants.

(*e*) A statement of the terms and conditions on which the supply is proposed to be given ; and

(*f*) An affidavit or stamped statutory declaration to the effect that the applicants are not by any Act of Parliament specifically prohibited from supplying electricity within the area in which the premises are situate.

3. The consent of the local authority, if given, should be given in pursuance of a resolution passed at a meeting of a local authority held after previous notice of the same and of the purpose thereof has been given in the manner in which notices of meetings of the local authority are usually given, and the fact that such a resolution was duly passed should be proved by a certificate signed by the clerk of the local authority reciting a copy of the notice and of the resolution, and declaring that the notice was duly given and the resolution duly passed.

4. The consent of any undertakers being a company authorised to supply electricity to the premises, if given, should be proved by a certificate signed by the manager or secretary to the company.

5. In cases where for the purpose of giving the supply the applicants require to break up any street not repairable by the local authority (including any street repairable by a County Council), or any railway or tramway they must (unless the authority, company, or person by whom that street, railway, or tramway is repairable consent to the breaking up thereof) apply to the Board of Trade under Sec. 13 of the Electric Lighting Act, 1882, for the written consent of the board authorising and empowering the applicants to break up that street, railway or tramway in the manner provided in this memorandum (see page 1).

6. Any costs or charges which may be incurred by the Board of Trade in connection with the application must be paid by the applicants.

The Board also stated that, in the event of their deciding to make an order, it would be necessary to refer the draft order to counsel, requiring a fee of three guineas. Now this, added to the cost of the affidavit mentioned in Clause 2, Sub-Sec. (*f*), of the Memorandum of Procedure, and the cost of cable, would in many instances preclude the supply from being profitable.

Again, as indicated in Clause 1, one may assume that the procedure must be gone through and the costs borne for each application to the Board.

One can imagine the comments of another Government Dept., namely, the Local Government Board, when a local authority applied for a loan and supplied the L.G.B. with the cost per service in detail, as they now require. Is it all necessary ?

Clause 6 of the 1909 Act sets out clearly the procedure, and ties up the undertakers sufficiently. Why, then, should the Board of Trade put undertakers to any expense if the evidence asked for is supplied ?

PROCEEDINGS OF INSTITUTIONS.

The "Electric Arc."

AT a meeting of the INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION), in Edinburgh, on February 11th, Mr. W. B. Hird, of Glasgow, contributed a paper on the *Electric Arc*, an electrically-propelled ship equipped by Messrs. Mavor & Coulson, Ltd., Glasgow. Mr. Hird, who confined himself mainly to the features of electrical interest, said that since the question of electrical transmission had been considered from the point of view of covering the whole field, including power for fairly large ships, it became evident that continuous current was not suitable. The only objection to polyphase plant was that it did not lend itself readily to any change of speed. The best-known way to change the speed was to provide the motor with windings which would enable it to be run either as a six or eight-pole machine. Another plan was to have two motors and run them in cascade. These methods had both a certain amount of complication. Mr. Mavor employed the "spinner motor," in which the outside part of the induction motor was mounted so as to be capable of rotating. This was controlled by a second induction motor built on the outside, and provided with a different number of poles, so that while the first motor would run at 500 R.P.M. they could drive the inside one at 250 R.P.M. in the same or in the opposite direction, giving three different speeds. In ship installations the current could be supplied at two different periodicities, and motors could be provided with two windings, one for 20, and the other for 33⅓ periods per second, each still giving the same speed. It was considered highly desirable that the rotor should be, if possible, of the squirrel-cage type, and have no windings. The simplicity of this rotor commended itself in that it had no connections outside, no contacts and no windings to give trouble or go wrong. Another point was that the arrangement should always be such as to involve no running in parallel of two or more generators, because synchronising was considered to be too delicate an operation on board ship, where the propellers might suddenly have to be varied in speed in cases of emergency. Taking all these points into consideration, it was finally decided that an experiment on a small scale should be carried out with a system in which three-phase current should be generated at two different periodicities of supply, the motor being provided with two windings on different numbers of poles suitable for receiving the two periodicities, and the result was the *Electric Arc* boat built at Dumbarton by Messrs. MacLellan & Whitson. The boat was 50 ft. long with a 12-ft. beam, and the displacement was about 19 tons. The propeller had a diameter of 3 ft. 6 in. In a small installation of this sort only one engine was provided, although two would be required for a larger installation. Both periodicities were got from one alternator. In the case of a larger installation the different periodicities would be supplied by separate machines. The vessel was put on the Clyde early in 1911, and had given quite good results on the lines expected. It had enabled them to show that the combination of generating motor and switchgear was workable, and would allow a boat to be easily and effectively handled. It was evident, however, that even with the largest type of boats a combined efficiency of 95 or 96 per cent. could scarcely be hoped for, and, therefore, it was necessary to show that by increasing their turbine speed and reducing the propeller speed they gained in propeller efficiency more than the 8 or 9 per cent. which they must lose in electrical gear in order to work profitably.

DISCUSSION.

PROF. BAILEY (Edinburgh) said the driving of ships seemed to lend itself very well to special speed contrivances, because one did not want to vary the speed of a ship as one varied the speed of a motor-car. But how would they go dead slow ? Another question which he did not understand was with relation to reversing. In reversing, the motor was not so satisfactory as the steam engine, as that could run at a low speed with quite as large a torque. They would require a very much improved squirrel-cage motor, but in other respects, when they were going full speed ahead or at half speed, it seemed an ideal system.

MR. STEVENSON suggested that in an experiment of this kind, the spinner motor would have been well adapted to meet the conditions, though he thought the double frequency would have given better results, so far as the mechanical side was concerned. He quite appreciated the squirrel-cage motor for the smaller sizes, but when they came to bigger machines there seemed room for doubt.

MR. ROBERTSON (Greenock) referred to the difficulty of synchronising alternating machines on board ship. Some years ago, he was able to obtain some details of a scheme got up by a large firm of electrical engineers for the electrical propulsion of a cruiser, which had been submitted to the Government. The weight of the vessel was 22,000 tons, and the alternators were to be run at 3,000 volts, with change-over switches operated from the bridge, the captain's room, or the engine room. The scheme seemed very complete and

well thought out, but there was no provision for changing the speed of the motor. It was full speed in each case, which meant that an auxiliary set had to be provided for half speed for cruising. The additional weight would be about 60 per cent. of the whole of the electrical installation, and that put the matter out of court. His opinion was that if the problem was to be solved, its solution lay in the principle Mr. Hird had suggested—double frequencies to drive the motors, or the use of some type of spinner motor.

Mr. Sam Mavor (Glasgow) said that the very high state of perfection to which the reciprocating steam engine had been brought made it difficult for any new method to gain a footing. Engineers should, however, bear in mind that generators for driving ships effected an enormous saving of weight on even that class of plant. He saw a scheme the other day for driving a yacht of 500 tons, and in comparing the electrical drive with the ordinary steam drive, there was a saving of 10 tons in weight—the steam plant weighing 100 tons and the electrical plant 90 tons. The centre of gravity was very much lower than in the case of a yacht with the usual top-hamper, and further, the increased area for the men in the mid portion of the ship was something like 9 or 10 ft. of her available accommodation.

In the course of his reply, Mr. Hird stated that the voltage was 310 volts, variable to a small extent either way. Great stress had always been laid upon not having two alternators in parallel in cases of ship propulsion. The scheme they were considering did not prevent a combination of three alternators and three different motors, unless the motors were all of the multiple wound type. If they had a ship with three propellers, a whole range of combinations could be obtained. As to the suitability of the squirrel cage, he thought Prof. Bailey overestimated the power required to reverse the propeller. The experiments showed that in this case it did not take the full torque corresponding to full load to reverse the propeller. They had made experiments which had shown that the ordinary propeller, when asked to act as a turbine, had a bad efficiency, and that accounted for the fact that the propeller would reverse more rapidly than would appear at first sight. The question of size was a different one. It was a squirrel-cage rotor that they had on this boat, and it was well known that if the vessel was small the squirrel cage would do what they wanted. It was only on bigger sizes that it failed. He thought that in the case of ship propulsion there were some considerations which would lead them to hope that they might come to higher sizes of squirrel-cages, chiefly because of the fact that they had there an installation which was at their disposal simply for the purpose of driving a squirrel-cage motor and nothing else. To change speeds in a big ship by simply throwing over a switch, would of course, be impossible. The switch itself would not stand it.

The Commercial Aspect of Electric Cooking and Heating.

By T. P. Wilmshurst, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Birmingham, February 26th*, 1913.)

The object of the present paper is to consider how far the use of electricity in the home is likely, in the near future, to supersede existing methods of cooking and heating.

The question of lighting may be considered settled. The author's experience for some years past has been that all new houses within reach of the mains, of a rental value as low as 7s. per week, are now wired as a matter of course for electric light, even though the initial cost may be £4 10s. per house, as against 30s. to 40s. for gas, as the owners now realise that houses fitted with electric light have a better letting value. The service cable should not be less than 7/18 S.W.G.

Probably more than half the revenue of a modern gas undertaking is derived from the cooking load, and the greatest cooking load in the smaller houses occurs on Sundays.

In London, in four years the number of gas cookers on the mains of the Gas Light and Coke Co. has increased from 312,865 to 475,853, and on those of the South Metropolitan Co. from 245,165 to 281,880. Manchester shows an increase from 36,214 to 53,730, Birmingham from 34,069 to 40,945, Derby from 11,819 to 17,500, Southampton from 16,834 to 21,473, and Coventry from 11,102 to 17,332. These magnificent results have been obtained by supplying an article which fairly well met the needs of the consumer at a low rental (usually 10 per cent. per annum), or free of all rental; by the innate advantages of availability and cleanliness; and by good business organisation, including intelligent canvassing and frequent popular demonstrations and lectures.

In a gas oven the joint of meat during the whole cooking operation reposes in an atmosphere consisting of the objectionable products of combustion of coal gas; and many consumers have, on taking up electric cooking, at once been struck with the vastly improved flavour of the meat. If it can be proved to the consumer's satisfaction that electric cooking is not more expensive than gas or coal-fire cooking, the battle will be won, as the innate advantages of the former are so considerable that progress is bound to be very rapid.

The author's first experience, about three years ago, was with a "lagged" or "black" oven made by one of the best firms in the country: the design, however, was crude, and the makers evidently had not studied the housewife's problem at first hand.

At Olympia in September, 1911, several types were exhibited which showed a marked advance in design; but it is, in the author's view, largely due to the business foresight of one man, Mr. A. F. Berry, that substantial progress is now being made. Mr. Berry has for some time past organised a series of lectures and demonstrations in various towns, given by Mr. F. S. Grogan, in co-operation with the local supply authorities; these practical demonstrations have done more to stimulate public interest than any amount of literature could have effected.

Prior to Mr. Grogan's visit only two cookers were connected to the Derby mains, and they were evidently regarded as luxuries, as the revenue from them was small and fitful. The Derby Corporation offered to lend a complete outfit to *bona fide* lighting consumers for a week's free trial, including temporary wiring, with the result that over 30 satisfied consumers were coupled up within two months; others have come on since, and several new houses are being completed in which cookers are arranged for.

The advantages of electric cooking are at once apparent to those who adopt it, the chief being:—

1. Absolute cleanliness.

2. Absolute certainty of results, owing to the voltage limit restrictions laid down by the Board of Trade. This is in marked contrast with the results obtained with gas cookers, owing to the wide fluctuations of gas pressure in practice, or with the results with coal ovens. With the "Tricity" system absolute evenness of temperature is attained by a simple arrangement of deflectors fixed under the top heater and over the bottom heater. With an electric cooker it is only necessary to weigh the joint and allow 15 to 20 minutes per pound, according to taste, and at the predetermined time the joint is taken out with the certainty that the meat will be cooked perfectly and without the door of the oven having once been opened.

3. A saving owing to the diminished loss of weight as compared with other methods.

This is the best money-saving argument, and although many convincing figures have been given both before the Institution and in the Press, a few further figures may not be out of place.

In the introduction to "Mrs. Beeton's Cookery Book" it is stated that with coal or gas-fired ovens the loss of weight in cooking beef or mutton is 25 per cent. to 33⅓ per cent., and with pork the loss is nearly 50 per cent. owing to the greater proportion of fat. With an electric cooker this is very much reduced. The following figures, some of which are taken from experience at Derby, relate to results with the "bright" oven, of which the "Tricity" is the best known type.

From the Coal Range.

	Raw. lb.	Raw. oz.	Cooked. lb.	Cooked. oz.	Percentage loss.
Sirloin of beef	7	4	4	4	41·3
Ribs of beef...	5	7	3	12	31·0
Boned sirloin of beef ...	4	0	2	13	29·7
Half-leg of mutton ...	4	0	2	13	29·7
Leg of pork	10	14	6	9	39·6

Marmalade making:—18 lb. orange pulp and sugar gave 13½ lb. of marmalade, or a loss of 25 per cent.

From the Gas Oven.

	Raw. lb.	Raw. oz.	Cooked. lb.	Cooked. oz.	Percentage loss.
Ribs of beef...	9	14	7	14	19·0
Sirloin of beef	3	2	2	6	24·0
Leg of mutton	8	4	6	0	27·3

From the "Tricity" Cooker.

	Raw. lb.	Raw. oz.	Cooked. lb.	Cooked. oz.	Percentage loss.
Ribs of beef...	10	14	9	13	9·8
Sirloin of beef	6	0	5	6	10·4
Ribs of beef...	5	3	4	13	7·2
Shoulder of mutton ...	4	14	4	5	11·5
Leg of mutton	9	1	7	10	15·8
Leg of pork...	10	8	9	0	14·3
Sirloin of beef	5	2	4	8	12·2
Ham...	10	0	9	7	5·6

Marmalade making:—17 lb. of orange pulp and sugar gave 14 lb. of marmalade, or a loss of 17 per cent.

A pork butcher in Derby cooks an average of 30 legs of pork per week, as well as pork pies, hocks, &c. For nearly six months this cooking has been done entirely on a "Tricity" double oven measuring 19 in. × 28 in. × 16 in. internally. This consumer assures me that the saving in meat is so great as far to outweigh the cost of current at 1d. per unit. And whereas the loss on his coal range was formerly 40 per cent., this is now reduced to an average of 20 to 25 per cent. The following table gives a few typical figures obtained from this consumer.

	Raw. lb.	Raw. oz.	Cooked. lb.	Cooked. oz.	Percentage loss.	Cost of current in pence.
Legs of pork	12	12	9	12	23	13
	12	8	9	10		
	13	12	10	10	22½	8
Pork and hocks ...	11	0	8	4	25	10½
Legs of pork	12	12	8	8	21½	11
	10	8	8	3		

Taking the first and last results, which represent the output of the double oven, the saving in weight over the coal range amounts to 18 per cent., or 4¼ lb. The cooked meat is sold at 1s. 2d. per lb.: therefore the net money saving on each two joints, after deducting the cost of current, is 3s. 10½d. and 4s. 0½d. This consumer also assures me that there is no comparison as regards the regularity of the results and the improved taste of the meat.

If the domestic consumer would take the trouble to keep a balance-sheet, setting the diminished but her's bills against the

cost of current, it could be proved every time to his own satisfaction that he was money in pocket at the end of the year.

A further obvious economy is the diminished consumption of coal in the kitchen. The annual consumption of coal in a house of, say, £50 rental is about 15 tons, of which at least 10 tons are used in the kitchen. In providing for warming the kitchen and providing hot water for baths, &c., probably not more than 4 tons are required, thus showing a saving of 6 tons, representing (at prices in the Midlands) £4 10s. per annum.

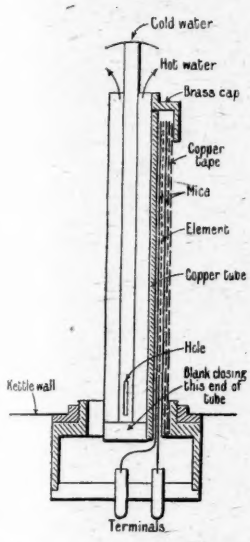


FIG. 1.—SECTION OF 1,200-WATT "BERRY" CARTRIDGE ELEMENT.

Users of electric cookers have soon discovered one grave defect, the absence of a quick-boiling kettle for small quantities of water. The ordinary consumer will not wait 10 minutes while the hotplate is warming up, and a further 7-10 minutes for the water to boil, when a kettle on a gas-ring can be boiled up in 10 minutes. To meet this difficulty a neat arrangement has recently been devised by Mr. Berry. A specially shaped kettle is used, into which can be inserted a cartridge element (fig. 1). The resistance strip is wound on a copper tube covered with a layer of pure mica, the connecting leads consisting of four strands of the element laid along the tubes in longitudinal grooves so as to prevent lumps. Over this strip is wound two layers of thin copper tape insulated from the winding by pure mica. A brass cap, fitting tightly on the tube and then opened out to slip over the tape, finishes one end; and at the other end is a brass terminal box, which carries the contact pins. When all the parts are assembled the whole apparatus is soldered up solid and watertight. A smaller tube is fixed down the centre of the main one into the plug closing the end carrying the terminal box, and has holes at the bottom end; the other end carries a small "umbrella." This arrangement allows the water to circulate inside, the "umbrella" preventing the overflowing stream from interfering with the cold water entering. The loading is 1,200 watts, and this can be assisted by standing the kettle on the hot-plate. With an initial temperature of 40° F. three pints of water can be boiled in six minutes with 2,000 watts, at an efficiency of over 98 per cent.

The author would suggest from his own experience the following points for the promotion of economy in the kitchen and for the satisfaction of the consumer:—

When cookers are first installed, fix for a few weeks an additional meter alongside of the cooker, and provide a card to show both the daily consumption and also the money saving on each joint of meat cooked. Provide a small red lamp or other indication that current is being used. For small houses use a 1s. or 6d. slot-meter, fixed near the cooker, and provided with an indicator which will show when the value has been expended. Follow up the first installation of the cooker by a visit from a lady expert to give advice and instruction.

The author's experience is that the consumers very soon find out how to get the best results from the cooker, so simple is it in operation.

The usual practice with gas undertakings is to let apparatus out on hire at 10 per cent. of the net cost of the outfit. This course has been adopted in Derby with electric cookers. The rentals charged are:—

For outfit, including "duplex" cooker, extension heater and oven	4s. 0d.	per quarter.
Including griller and grease pan ...	4s. 3d.	" "
Additional extension heater	1s. 4d.	" "

The small utensils used with the hot plates are sold outright at prices approximately 10 per cent. above the net cost.

The consumption of energy, at any rate with the "bright" oven, usually amounts to 1 to 1½ units per person per day; the lower figure may be obtained by strict economy, and at 1d. per unit the author believes this will compete with gas at 2s. 6d. per thousand cubic feet.

With electricity at ¾d. or ½d. per unit, as is now charged in some towns, there is no question of the economy of electric cooking.

To some engineers, the warming of rooms offers an even more attractive problem than electric cooking, on the ground of the much lower selling and hiring prices of radiators; on the other hand, it must not be forgotten that they are very little required in summer, whereas the cooker is an all-the-year-round load, and is even more used in summer than in winter.

It is difficult to lay down definite rules for the amount of electrical energy required for warming rooms, as it depends on so many factors, such as the window area and the user's idea of fresh air. For proper ventilation it is necessary to change the air of a room three times an hour.

A good rule, based on hot-water practice, is:—

$$\text{Kilowatt capacity} = \frac{(30\,A + 8\,B + \times\, n\,C)\,20{\cdot}4 \times l}{60 \times 60 \times 1{,}000},$$

Where A = number of square feet of window surface; B = number of square feet of wall surface; C = number of cubic feet of air in room; n = number of times air is changed per hour; l = number of degrees F. the air has to be raised in temperature.

Thus in a room 30 ft. × 16 ft. × 10 ft., with three windows 3 ft. 6 in. × 6 ft., would require 2·5 KW. to raise the temperature 20°; and a room 16 ft. × 14 ft. × 10 ft. high with one window 5 ft. × 3 ft. 9 in. would require 1·3 KW. to raise the temperature 20°.

The electric radiator contains all the elements of success. It is clean, portable, cheerful and instantaneous. The present difficulties are the innate conservatism of the householder, the necessity for two sets of wiring where ordinary flat rates of charging are in force, and the running cost where the radiators are used for long hours at the ruling price of 1d. per unit.

It is unnecessary to point out the absurdly low efficiencies of coal and gas fires owing to the necessity of providing for the disposal of the products of combustion. In the aggregate, the smoke nuisance from domestic chimneys is far more serious than from factory chimneys, and if more attention were paid by the municipal authorities, as it should be, to the prevention of smoke from private houses, an enormous impetus would be given to electric heating.

Water heating is, financially, by far the most difficult problem to deal with. Comparing coal, gas and electricity on a calorific basis, the case for electricity appears to be hopeless, and its only salvation lies in the exceedingly high efficiency of the electric heater. Taking coal at 17s. per ton, and 13,000 B.TH.U. per lb., gas at 2s. 6d. per 1,000 cb. ft. and 600 B.TH.U. per cb. ft., and electricity at 1d. per unit and 3,455 B.TH.U. per unit, a comparative statement is somewhat as follows:—

	B.TH.U. obtainable for 1d., assuming 100% efficiency.	Efficiency in practice (say)	Useful B.TH.U. obtained for 1d.
Coal	142,750	10 %	14,275
Gas	20,000	50 % (with geyser)	10,000
Electricity	3,455	90 %	3,109

The author has seen tests made by an independent and reliable authority in which an efficiency of over 97 per cent. has been gained with a Belling electric geyser.

The three most notable attempts to solve this problem are the Therol heater, the Belenus boiler and the Belling geyser.

In the first mentioned, the heating coil is embedded in a block of cast-iron, providing a large degree of thermal storage. The capacity of the coil varies from 50 watts to 900 watts in the large sizes, and the hot water at 110° F. varies from 5 gallons to 135 gallons per day. The apparatus is the essence of simplicity, and provides a demand of 100 per cent. load factor, obviously forming a most desirable load, even at an exceedingly low price for electrical energy.

An interesting installation of Therol heating in a private house in London may be mentioned. The household consists of seven persons, including two children. A 300-watt heater is installed with an auxiliary 1,000-watt unit, also a small 200-watt heater for the kitchen and scullery; there are three baths required per day, and of course, hot water continually for other purposes. This installation has replaced a gas circulation heater. After one year the consumer found a saving of 7½ per cent. in actual payments, as well as a saving in deterioration of decorations. The price paid for current, based on £4 per kilowatt installed plus ½d. per unit, came to about 0·65d. per unit.

The Belenus boiler consists of a column of cast-iron provided with deep corrugations along the bore in order that the surface in contact with the water may be as great as possible, and with a number of deep slots on the outer surface in which the elements are embedded. These elements are plain strips of inert material, wound with heavy gauge wire run at a low current density, and are insulated by pure mica from the column. There is at least ½ in. of cast-iron between the elements and the water. The boiler, when arranged as a circulation heater, is always full of water, and the elements can never attain a high temperature or burn out.

The boiler is installed in exactly the same manner as the old-fashioned saddle-back kitchen boilers, iron pipes being run from the top and bottom to the top and bottom respectively of the household hot-water tank. In old houses the electric boiler can be fitted in the riser to the tank, and employed to reinforce the kitchen boiler and to take its place in the summer. The boiler is provided with a steel case and air lagging around the column. A high efficiency is attained when sheet lagging is fitted over this and the pipes are lagged in the usual manner. The Belenus boiler can be installed in the kitchen, scullery, or any convenient out-of-the-way position; it can be fixed in series with the kitchen boiler and simply switched on when the fire is not in use.

The Belling geyser is somewhat similar in operation to the Belenus boiler, but it has in addition a control gear by which the electric switch and water supply handles are interlocked so that it is impossible to switch on the current before the water, or to turn off the water without first switching off the current. Independent tests show an efficiency as high as 98 per cent. The heavy loading of 10 KW. is, however, an objection.

Undoubtedly the cheapest solution of the problem, at the present time, would be to discard the kitchen fire altogether; to fix a coke stove of the "Ideal," or other type, for hot water purposes, and to

cook by electricity. A small "Ideal" boiler will supply 50 gallons of hot water per hour at, say, 120° F. for 30,000 B.TH.U. per hour, or, say, ½d., a result not yet approached by any other method.

Supply engineers are now realising that the application of the Hopkinson system of charging in one form or another is a necessity for domestic supply, if heating and cooking by electricity are to make rapid headway.

The two best known modifications are the "Norwich" system and the "Telephone" system. In the former the initial charge is a percentage of the rateable value, plus a low charge for current. At Norwich the rate is 12½ per cent. of the rateable value, plus 1d. per unit for all current consumed. At Bradford the rate is 15 per cent., plus ½d. per unit, and at Sunderland 10-15 per cent., according to the size of house, plus ½d. per unit.

In the "Telephone" system the initial charge is based on the connected lighting load. In Marylebone the charge is based on 70 per cent. of the connected lighting load at £14 per KW., plus 1d. per unit.

A house on the Derby mains is rented at £48, and the rateable value is £40. The consumer, during 1912, paid for—

250 lighting units at 4½d., or	£4	13	9
2,100 heating units at 1d., or	8	15	0
Total	£13	8	9

Average price, 1·37d. per unit.

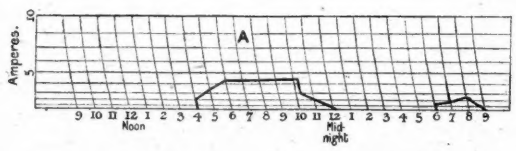
Under the Norwich system at 15 per cent., plus ½d. per unit, he would pay :—

Initial charge...	£6	0	0
2,350 units at ½d.	4	16	8
Total	£10	16	8

and all additional units would be obtained for ½d. per unit, thus giving every encouragement to use more heating units.

From the preponderance of heating over lighting units in the above case it will be seen what enormous developments are possible, especially in towns which depend on lighting rather than power for their revenue. The preponderance may also be emphasised by a comparison of figs. 2 and 3, which are the lighting and the heating recorder charts for the house above mentioned.

FIG. 2.



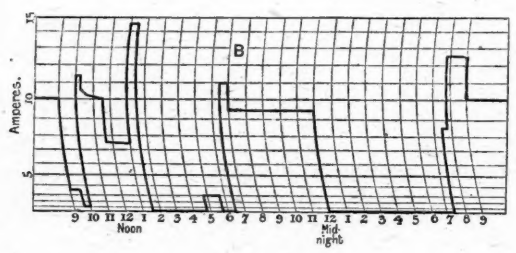


FIG. 3.

At Southampton, Mr. H. F. Street informs me that prior to 1910 only 20 radiators were in use. Since the institution of a flat rate of ½d. per unit, however, about 1,000 radiators have been connected, and more than half of these are of the 2-KW. type. At Luton, Mr. W. H. Cooke has sold about half a million units for heating during the last year at a low price. It is obvious, therefore, that once a satisfactory price can be adopted the load will follow, as a matter of course.

DISCUSSION.

MR. FRED. S. GROGAN (British Electric Transformer Co., Ltd.) said he congratulated Mr. Wilmshurst upon his paper dealing with practical results obtained from the "Tricity" cooker, especially as he had accepted the manufactured article instead of, as was often done in the very smallest supply stations, attempting to design his own cookers, and, with experimental work costing a few pounds, expecting to do what had cost the manufacturer thousands of pounds. He agreed with the author in having heavier service cables, and would go even further and specify 7/16 S.W.G. as a minimum. From the latest returns he found there were almost 3¼ million gas cookers in use in the United Kingdom, so that a large field was waiting for the enterprising supply engineer. Undoubtedly excellent results had been obtained where good organisation existed and popular demonstrations were given. Having been the first to introduce these cooking lectures, he said that such a lecture must not consist of a dry cooking lesson, but must teach the audience how to apply their own cooking knowledge to the newer methods, and deal with the question of cost of operation in both the new and old methods, at the same time bringing out the advantages of electric cooking. The gas companies started by denying that a saving in shrinkage could be effected, but they were now producing figures showing that they could cook with the same saving in weight as with an electric oven. He had formed the opinion that the saving with the electric method was entirely due to their ability to alter quickly the temperature in the oven. The meat was first seared for a short period at a high temperature, and then cooking was continued at a much lower temperature. Such a saving could be effected in the older methods of cooking, but only with an infinite amount of care on the part of the cook, and continual attention to the oven during the cooking operation. That was why electric cooking would always win, because this saving could be effected without any attention on the part of the cook. The "Tricity" system would obtain such results with the minimum of trouble, because there was not a large mass of iron to be heated up in preparing the oven for cooking. It naturally followed that any oven employing large masses of iron must gradually accumulate a large quantity of heat, and the temperature in the oven could not, therefore, be rapidly lowered on account of the reserve heat in the casting, unless a great amount of care and watching was given in the cooking operation. As a proof of the ease of manipulation, he was visiting many towns during the year, and invariably cooked a joint of meat for the public to see for themselves the great saving. He did not take a number of joints and select a special one to show, but cooked only one joint, and always got the same result—a shrinkage of 10 per cent. With a cooking outfit supplied to a school at Eastbourne by his company, the results averaged over last term gave a consumption of just under ½ a unit per head per day. There were in all 100 people to cater for, and besides the ordinary daily meals for boys and staff, the adults were served with a full course dinner in the evening. Coming to the water heating, about 95,000 useful B.TH.U. of heat were obtained for 1d. from the "Ideal" coke boiler. He asked them not to rush at doing everything electrically just because they were electrical men. The hot-water-supply-in-bulk problem was one which they should leave alone; both electricity and gas were beaten hopelessly on cost when compared with the coke stove. He preferred to have the independent hot water boiler connected in parallel not in series with the kitchen boiler. Where he had installed electric cooking, he had also put in many independent coke boilers, and they worked perfectly when coupled in parallel. The disadvantage of the series arrangement was that when the kitchen fire was not working the whole of the circulating hot water passed through the old boiler at the back of the kitchen range, and rapidly lost heat by its proximity to heavy masses of iron. He strongly advocated the charging of an annual fixed sum plus a low price per unit, for this would encourage those already connected with the supply mains to use more electricity for domestic purposes, and the supply engineer would rather increase his load on existing services, than extend by new connections. He noticed the excellent progress reported in Southampton, and would like to emphasise the fact that about 70 per cent. of the radiators were hired out by the Corporation ; if the number placed in one large installation, where the radiators were bought, was omitted, the percentage of hired radiators was considerably increased, thus driving home again the condition pointed out by the author as being necessary for success, viz., hiring apparatus at a low rental.

MR. W. FENNELL said he was convinced that two things were necessary before it was advisable to push electric cooking. A suitable tariff, and an electric oven at £4. He had at Wednesbury the Norwich system for private consumers—10 per cent. of the annual rateable value plus 1d. per unit in winter and ¾d. per unit in summer. Having provided the proper tariff, he was now waiting for the manufacturer to come along with the oven ; when he saw the oven, he would push electric cooking. It was useless to offer an oven for hire at £1 per quarter (and that was necessary with the £12 to £15 outfit), while the gas authorities offered the equivalent at 3s. 6d. Water boiling by electricity was uneconomical, and to combine this with the oven was sure to cause the whole apparatus to be rejected, in an industrial district. He had had two years' home experience of electric cooking, with both the types of oven described ; both cooked splendidly, and they did not know what good cooking was until they had the electric oven. They would not change back to coal or gas. The hot-plate portions were not used (he could not face the bill), so they conducted all the boiling operations on the top of the old gas range. He was, therefore, speaking from experience when he said, "Push the oven, and leave the boiling for the gas people." Hot water jugs, afternoon tea kettles, toasters, &c., for use on the table were very successful, because large quantities of heat were not required. They added a little to the revenue, and greatly to the reputation of the electricity supply. Regarding the percentage losses in weight (gravely carried to decimal points), he thought it unwise to make too much of the point, because it was easy for the other side to retort that this much-vaunted saving in "meat" was only a saving in water, which was not worth anything unless they were going to sell again by weight. It would be better, therefore, to keep on safe ground by maintaining that cooking in an electric oven was very simple, and reasonable in cost, and that the result was a cooked article, whether meat or pastry, which was far superior to that produced in coal or gas ovens.

MR. N. B. ROSHER gave some particulars of a proposed electrical cooking installation for the office staff of some works, numbering 20 persons. Relying upon the published figures as to saving in cost with electric cooking due to less shrinkage of meat, it was

estimated that this system would pay handsomely, but an experiment carried out to ascertain the relative cost of cooking by gas and electricity resulted in favour of the former. It was only fair to state that the same cook cooked both joints, but that whereas she was experienced with the gas cooker, she had never before used an electric oven.

Mr. W. C. S. Phillips suggested that the difference in results obtained by means of the "Tricity" cooker and the gas oven might be due to the difference in mechanical construction of the two ovens. The electric cooker was practically a closed box.

Mr. Morrison said that the results obtained with "black" or lagged ovens were of the same order as those obtained with "bright" ovens.

Institution of Electrical Engineers (Manchester Section).

The annual dinner of the Manchester Section of the I.E.E. was held in the Midland Hotel, Manchester, on Friday last. In the absence of the chairman (Mr. A. A. Day), Prof. E. W. Marchant presided. There were present 184 members and friends, including the Lord Mayor of Manchester, the President of the Institution of Electrical Engineers (Mr. W. Duddell), Profs. Rutherford and Petavel (Manchester University), Dr. Rosenberg, Mr. S. Z. de Ferranti, Messrs. S. L. Pearce, C. D. Taite, J. E. Kingsbury, W. Cramp, W. C. Mountain, J. Frith, hon. sec., and A. L. Green (assist. sec.).

After the loyal toasts had been duly honoured, Mr. S. Z. de Ferranti proposed "The Corporations of Manchester and Salford." He said a great change had come over the electrical industry. At one time manufacturers viewed each other with a very great amount of suspicion, but recently this was changed, and there was now a tendency to a certain amount of co-operation between manufacturers which would help both the latter and the public generally. A good deal of preference had been shown to municipal authorities in the Electric Lighting Acts. Some people considered it desirable for public bodies to go in for trading; on the other hand, there was the opinion that only private business firms should trade. He believed that the best method of carrying on the supply of electricity was by a combination of the local authorities and private companies. In the United States, powers were granted to public companies to provide lighting and power supplies over large areas on the basis that when the money subscribed by the shareholders had earned a fair rate of interest, the surplus should be divided between the municipality and the shareholders. In this country we were, generally speaking, suffering from too high prices. An enormous development would take place if only people would take more risk by supplying at a lower rate. Risk, however, was not the sort of thing a public body should undertake to any great extent. He had given a good deal of thought to the subject, and had come to the conclusion that the best way of giving a cheap and efficient supply was by the co-operation of the private company and the municipal authority—a co-operation which would have the stability of the municipality and the business keenness of the private company.

The Lord Mayor, in replying, said electricity supply was in itself of the nature of a monopoly. They could not have half-a-dozen companies competing in the streets of Manchester. Whether they adopted the American or the German system, it was only a half-way solution. Manchester, it would be admitted, supplied electricity at as cheap a rate as most of the towns in the country, and at a cheaper rate than other towns which had not special advantages in this way. He was not one of those who believed that the trading departments of a Corporation should make handsome profits in aid of rates. After those departments had paid interest and sinking-fund charges, and, say, 1 per cent. or 1½ per cent. for the risk—if there was any risk—the remainder should go to the reduction of prices, and if there was any good in electricity, the low price would stimulate the demand. He was of the opinion that Mr. Ferranti was on the wrong line, and that, in the long run, those things that were in the interests of the people must be worked by municipalities or the State for the benefit of the people.

Prof. Rutherford proposed "The I.E.E.," to which the President and Prof. Marchant replied. In the course of his remarks Mr. Duddell said that the Council of the Institution had decided to do some research work in connection with the properties of materials used in electrical engineering. In London there was to be found one of the finest libraries of electrical literature in the world. The Council were also forming a lending library, so that provincial members could consult a book without the expense and inconvenience of visiting London for that purpose. He wished that there should be no misunderstanding on the question of the proposed examinations. They were to be of such a character that any man who knew his work well could pass them without any cramming.

Prof. Marchant, in replying to the toast, spoke of the large amount of electrical engineering work done, and power supplied and used in and around Manchester and Liverpool. The Manchester Section possessed great opportunities for discussing all matters relating to electrical engineering, and it would be the aim of the Committee to foster in every possible way the interest of the members in the work of the Section, by providing papers of the widest range, which would give those engaged in the profession in the district the opportunity of supplying practical information on the branches of work on which they might be engaged. He hoped that in the future as in the past, the papers and discussions in Manchester might become known for the breadth of their scope, and for the practical value of their matter.

Mr. W. Cramp gave "The Visitors," to which Mr. E. W. Langdon responded.

A 60,000-VOLT UNDERGROUND CABLE INSTALLATION.

In a paper read before the Elektrotechnischer Verein, Dr. Leon Lichtenstein* gives some interesting particulars of what is probably the first 60,000-volt A.C. underground cable to be laid. The installation is one for supplying single-phase power to the Dessau-Bitterfeld railway, from the central station at Muldenstein. The transmission distance is at present only 4·3 km. (2·7 miles), but this extra-high pressure was selected partly to meet the requirements of future extensions, and partly for the sake of obtaining experimental data. The cable described was made by the Siemens-Schuckert Co., and forms one of three sets of feeders connecting the same points, another of them being a similar cable supplied by the Felten & Guilleaume Co., and the third an ordinary overhead system. The cables came into full operation at 60,000 volts and $16\frac{2}{3}$ cycles per sec. in April, 1911, and have been successfully operated (at comparatively light load) ever since, the two makes of cable being generally used alternately for a week at a time each.

The central station contains a turbo-generator of 4,100 K.V.A., at 3,300 volts, 1,000 R.P.M., and some smaller machines, and eventually four more similar turbo sets are to be added. The energy from each turbo set is transformed to 60,000 volts, in two 2,000-K.V.A. transformers, and at the far end the voltage is reduced in similar transformers to 10,000 volts, which is supplied direct to the overhead line of the railway. The middle point of the 60,000-volt system is earthed at the station through a high resistance, so that the voltage of each cable to earth is limited to 30,000 volts. Every provision against high voltage rises has been made, but no particulars of the arrangement are given.

It was decided to employ two single-core cables in preference to a two-core cable, as the experimental data available for the latter type were less complete. In order to avoid undue losses in the cable sheathing no iron armouring is used.

The cable core is of stranded aluminium, and has a section of 100 sq. mm. (·157 sq. in.). This is covered with a radial thickness of 13 mm. of impregnated paper, as shown in fig. 1, p. 414. Outside the lead covering there is a layer of jute, and this is coated with asphalt and chalk.

The permissible load of the cable is about 240 amperes for a maximum temperature rise of 25° C., so that the full-load output of the cable is 14,400 K.V.A. At 240 amperes the ohmic drop is about 150 volts per km. run, and the inductance drop about 35 volts per km. run, so that the net voltage difference between the two ends of the transmission works out at about 650 volts, or 1·1 per cent., with a power factor of ·9.

If a copper conductor had been used of equivalent carrying capacity, its section would have had to be about 57 sq. mm, with a radius $r = 4\ 75$ mm. With the same radial thickness of insulation ($\delta = 13$ mm.), this would mean a maximum number of volts per mm. near the surface of the wire of—

$$\frac{\text{volts to earth}}{r \log_e (r + \delta/r)} = \frac{30{,}000}{4{\cdot}75 \log_e 17{\cdot}75/4{\cdot}75} = 4{,}790,$$

whilst with the actual aluminium cable the maximum volts per mm. work out at—

$$\frac{30{,}000}{6{\cdot}5 \log_e 19{\cdot}5/6{\cdot}5} = 4{,}200,$$

or some 14 per cent. less. To give the copper cable the same maximum stress, the paper would have had to be increased to 16·7 mm. radial thickness, making the overall diameter inside the lead 42·9 mm. in place of 39 mm. The use of aluminium in this case was, therefore, considered to be fully justified.

The cable was manufactured in lengths of 750 m., so that, in all, 10 joints were required on the system besides the four special end-connection pieces.

The junctions were insulated with impregnated paper by hand, whilst the cable ends were similarly treated and

* *E.T.Z.*, January 2nd, 1913.

then encased in special porcelain covers, to exclude the air. No special difficulties were experienced in this direction, as the single-core cable lent itself much more readily to treatment than would a multi-core cable.

The laying of the cable along the railway line commenced in the middle of October, 1910, and was completed in the middle of December. The two cables are laid side by side in split earthenware troughs filled with sand, in a single trench ·8 m. deep, as shown in fig. 2. Where the cable had to be laid over the railway bridges, it was placed in wooden troughs. The sections of both troughs are shown in figs. 3 and 4. The laying was carried out under somewhat difficult weather conditions, the mean temperature being only about 5° C., whilst the joints were made with an air temperature of − 2° C. to − 5° C., and so had to be surrounded by artifically-heated tents during the process.

Measurements made in the factory before laying, and at a temperature of 15° C., showed an insulation resistance of 3,000 megohms per km., a conductor resistance of ·275 ohm per km., and a capacity to lead of ·169 microfarad per km. The latter figure enables the mean value of the specific inductive capacity or dielectric constant K of the insulation material to be estimated :—

$$\text{Capacity in microfarads per km.} = \frac{K}{2\log_e(r+\delta)/r} \times \frac{1}{9},$$

from which $K = 3{\cdot}35$.

After laying, the values were again measured, and showed the following results :—8,620 megohms per km., ·265 ohm per km., and ·1705 microfarad per km. The differences are accounted for by the fact that the temperature was lower (being about 4° C. in place of 15° C.), and serve to indicate that no damage can have been done to the cable during laying, in spite of the fact that it was unarmoured. When these three constants were again measured at the end of 1911, they still showed the same values. The cable was further tested with 50,000 volts to earth (corresponding to a line-to-line voltage of 100,000).

Such a test was only possible in this case, because it was permissible to earth one pole of the transformers temporarily, and because the length of line and the frequency were both moderate. Even so the charging current taken would be about $2\pi \times 16\frac{2}{3} \times 50{,}000 \times {\cdot}17 \times 4{\cdot}3 \times 10^{-6} = 3{\cdot}83$ amperes, corresponding to an apparent power of 190 K.V.A.

The writer points out the difficulty that would be met with in testing a longer line, and at a more usual frequency, such as 50 cycles. Even supposing that compensating choking coils are inserted to reduce the K.V.A. taken from the supply, the size of these choking coils would introduce fresh difficulties. He suggests that possibly some such device as the high-tension rectifying commutator described before the Turin Electrotechnical Congress in 1911, by Herr Delon, might be employed to test such cables after laying, with H.T. direct current, but before this can safely be done further experiments as to the relative effects of A.C. and D.C. high voltages must be carried out.

Although this cable is normally intended to work at 30,000 volts to earth, it is possible, under certain circumstances, to have one cable working at 60,000 volts to earth if a short-circuit to earth occurs on the other. This increased voltage would, of course, not damage the cable instantly, but in order to prevent its continuing for any length of time, an automatic indicating device is provided at the station to draw attention to any earthing of either pole.

Special earthing rods are also provided both at the central station and at the sub-station, which connect the cable to earth through a resistance when it is disconnected from the bus-bars. In this way, any danger from residual charge on the cable is avoided. The cable has been in regular use, although only at the small current of 10 amperes, for alternate weeks and about 20 hours a day, since April, 1911, and only one serious accident has occurred. On this occasion (in July, 1912) a H.T. transformer in the main station and the cable itself were both found to have broken down. Very careful tests, and examination of the cable since, show that nothing in the shape of ageing can have been the cause of the trouble, as neither the break-down voltage nor the electrical constants had altered appreciably, whilst the appearance of the paper, &c., was quite unchanged. Since repairing the fault the cable has again been in use for some months without any trouble, so that the accident must be put down to some outside undiscovered cause.

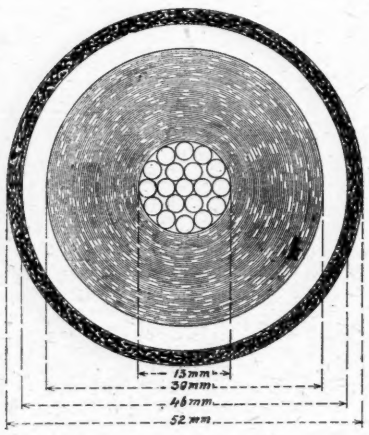


FIG. 1.

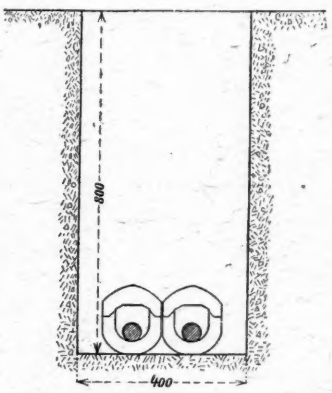
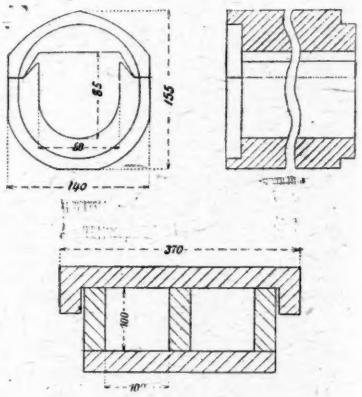


FIG. 2.



FIGS. 3 AND 4.

A point of some importance in connection with H.T. cables is the question of dielectric hysteresis loss. Under normal working conditions this should amount to a very small value, and in this case it was, in fact, too small to measure directly with the available apparatus. The loss to be expected can, however, be approximately estimated by reference to Höchstädter's tests made in 1910* on cables of similar manufacture. The writer has done this, and finds that the loss for the whole line (4·3 km. run) at 30,000 volts to earth, and $16\frac{2}{3}$ cycles, should only amount to about 2 KW. This is only about 1·45 per cent. of the full-load C^2R loss in the line, and should produce about 1·45 per cent. of the temperature rise at full load. The full load temperature rise is estimated to be 25° C., so that a rise of only about ·36° C. might be expected, due to the dielectric hysteresis loss alone. A 20-hour no-load temperature test was made on the cable in October, 1911, and the temperature rise was estimated from careful measurement of the copper resistance. This rise proved to be of the same order as that estimated, thus showing that no serious dielectric loss or eddy-current loss in the lead covering could be taking place.

Truro Electric Lighting.—The electricity question has this week been the subject of an inquiry at the B. of T. offices in London, when the claims of the T.C. and the Gas Company for a prov. order were considered.

* *E.T.Z.*, 1910, page 355.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Siemens Radiator Flexible.

The illustration, fig. 1, shows a specially designed wire, which Messrs. Siemens Bros. & Co., Ltd., Woolwich, are supplying for use with all kinds of heating apparatus, such as radiators and irons; it is also suitable for portable hand lamps in garages and other places. It contains two rubber-insulated flexible conductors of fine tinned copper wires, and can be provided, when necessary, with an earthing wire to meet the Home Office Regulations for workshops. The wire is supplied with either a polished cotton braid finish or a flexible metallic covering, the latter being recommended where the wire is likely to be subjected to severe mechanical use. In either case, a special feature of the wire is the provision of a wrapping of metallic foil immediately beneath the cotton braid which protects the rubber insulation from grease, oil and other injurious substances. It is desirable that the surface of any metallic protective covering employed for this class of wire should be perfectly smooth, so that it can be handled without any possibility of the slightest injury being caused to the user, such, for instance, as would result from the sharp points of broken wires of a metallic braiding. It will be seen from the illustration that this condition is fulfilled by covering the wire with a spiral wrapping of segmental aluminium or brass, the rounded outer surface of

Fig. 1.—Siemens Radiator Flexible.

which gives the finished wire a very neat appearance. The finished product possesses the required degree of flexibility without being springy.

The "Klipton" Lamp.

Messrs. Rose Bros., of 38-39, Beech Street, Barbican, E.C., have recently added to their "Klipton" specialities an improved large size lamp for use with current from the mains—the original "Klipton" being a pocket lamp for use with dry batteries.

The new fitting, shown in fig. 2, is, of course, of more substantial build than the earlier one, and is finished in lacquered brass with a strong clip and hand-made ball-and-socket movement, a reflector, 3 yd. of flexible, and an adapter or plug, as desired, for coupling to the main supply. Like its predecessor, it is a most convenient accessory, which can be clipped on to any ledge and adjusted to give light where wanted, or if clipped on to a ruler or book, will take the place of a standard lamp on a table. It appears to be a particularly useful adjunct for shop window lighting.

Tailoring Irons.

The introduction of the electric iron into tailoring shops will confer great benefits upon the employés, but the heavy duty required of the iron calls for a device much more highly developed than the ordinary laundry electric iron. To meet this need, the General Electric Co., Ltd., has produced the "Magnet" tailoring

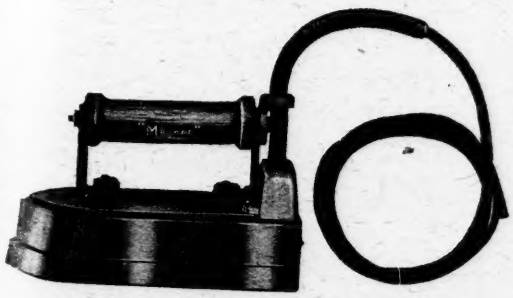


Fig. 3.—Magnet Tailoring Iron.

iron, which is illustrated herewith; this is made in weights varying from 12 to 25 lb., the former size being adapted for dressmakers' use and the latter for heavy tailoring work. Special attention has been given to the flexible connection, the weak spot of the electric iron; the cord is very strong, and is heavily insulated with rubber covered with a thick layer of asbestos and heavy cotton braiding over all. Connection with the heating element is made in a substantial box, to which a strong spring is attached, supporting and protecting the flexible for a length of about 9 inches. The heating element consists of a narrow metal ribbon of special alloy, and is readily replaceable. Ample heat is provided, and the design provides for reliability and efficient working.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—The Commonwealth Customs authorities have issued the following decisions as to the duties to be levied on certain imported goods:—

Etching machine: motor, blower and switchboard	20 % ad val.
Ruberoid or ruberine cement	(classification to be decided on analysis)
Surgical and dental instruments: "Multostat," including the motor, which is an integral part	free
Electric motor-wagons:	
Body	£36 each
Chassis	free
Vulcanising equipment	25 % ad val.

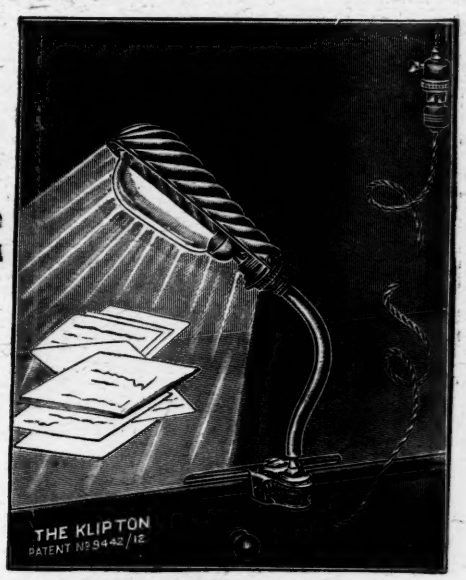


Fig. 2.—New "Klipton" Lamp.

Note.—The duties given above are in all cases those levied under the Preferential Tariff applicable to goods of British origin.

BRAZIL.—The Brazilian Budget Law provides that clearance of goods for consumption in Brazil will not be permitted without presentation by the consignee of the original Consular invoice, unless the consignee enters into an engagement to produce the document within a period of 90 days. This period may not be extended, and if the invoice is not forthcoming on its completion, the consignee will be liable to a fine of 50 per cent. of the total amount of duties and other charges leviable in respect of the goods.

The Brazilian Budget Law provides that goods which have undergone transhipment in foreign ports shall not be cleared through Customs Houses of the Republic unless they are accompanied by a transit certificate issued by the Consular agent at the port of transhipment.

BOLIVIA.—A Commission has been appointed to revise the existing tariff of import duties. The Commission is to communicate with all Chambers of Commerce in Bolivia inviting suggestions for the modification of the tariff, and is to submit a new draft tariff in August next. If the new tariff is approved, it will come into force on January 1st next.

MEXICO.—The Board of Trade are informed that the Bill for the revision of the Mexican tariff, referred to in these columns some few weeks ago, has been postponed until the ordinary session of Congress, which opens on April 1st next.

A decree has been issued increasing the rates of duty under the Mexican tariff by 10 per cent. from February 16th. This 10 per cent. includes the 5 per cent. increase imposed on goods imported from September 1st, so that the net effect is to increase the rates by a further 5 per cent. only.

Eccles Electricity Supply.—The Public Lighting and Electricity Supply Committee of the Corporation has considered a report of the Manchester Steam Users' Association upon No. 1 boiler. The engineer recommended the provision and fixing of a new boiler, at an estimated cost of £360, allowing for the sale of the present boiler, estimated to last 10 years, at a cost for repair of £165, and the Committee adopted the recommendation and decided to invite tenders.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

3,976. "Mechanical shutters for operating box in picture halls that can be closed quickly with electricity from one or more places in the hall or box in case of fire." F. Bradshaw. February 17th.

3,987. "Electric lighting switches for automobiles." M. S. Conner. February 17th.

3,988. "Non-conductor connection." T. E. Orange. February 17th.

4,008. "Electric apparatus for heating or boiling liquids." M. Railing and C. H. Archer. February 17th.

4,034. "Process for the manufacture of filaments for electric glow lamps." A. Just. (Convention date, March 11th, 1912, Germany.) February 17th. (Complete.)

4,071. "Telephony." D. S. Hulfish. February 17th. (Complete.)

4,090. "Process for manufacturing electric transformers of small power." Vedovelli, Priestley & Co. (Convention date, February 2?th, 1912, France.)

4,091. "Method of and means for winding coils." (Convention date, January 10th, 1912. Divided application on 91 of January 1, 1913.)

4,093. "Electric motor-controlling devices." British Thomson-Houston Co., Ltd., and H. E. Britton. February 17th. (Complete.)

4,106. "Ignition lead cases for motor vehicles and wagons." Clayton and Co. (Huddersfield), Ltd., and A. Briggs. February 18th.

4,117. "Means for attaching shades to electric and other lamp fittings." W. S. Ross. February 18th.

4,131. "Rheostat." T. Rhodus. February 18th. (Complete.)

4,164. "Order telegraphs." A. H. Pollen and H. Isherwood. February 18th.

4,197. "Electro-magnetically operated diaphragms for producing sound." E. A. Graham. February 18th. (Complete.)

4,225. "Device for holding a coil or coils of insulated or other wire which is being used in the installing of electric lighting, bell and telephone, and like systems." H. W. Brotherton. February 19th.

4,230. "Electric switches." L. Rasch. February 19th.

4,239. "Device for assisting in setting or timing the ignition and valves of internal-combustion engines." W. H. Leeke and A. J. K. Wilesmith. February 19th.

4,256. "Electrical signalling apparatus for lifts and the like." G. A. London. February 19th.

4,297. "Electric mercury switches." T. Gruber. February 19th. (Complete.)

4,344. "Telephone silent-speaking apparatus." F. Hodgson. February 20th.

4,345. "Insulated rail-joint for track circuit railway signalling." R. C. S. Woods. February 20th.

4,349. "Holders for testing motor sparking plugs." W. T. Lord. February 20th.

4,355. "Electric ozone generators." C. W. Denny. February 20th.

4,381. "Spark-plugs." F. R. Blake. February 20th. (Complete.)

4,383. "Electric contacts." E. M. Wildey. February 20th.

4,396. "Intercommunication telephone systems." Sterling Telephone and Electric Co., Ltd., and F. G. Bell. February 20th.

4,397. "Lighting fixtures." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 20th.

4,398. "Protective devices for electric distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 20th.

4,401. "Dynamo-electric machines." C. Schlick. February 20th. (Complete.)

4,405. "Electric typewriter." R. Imme. (Convention date, February 27th, 1912, Austria.) February 20th. (Complete.)

4,406. "Electric train lighting." G. W. Macartney. February 21st.

4,425. "Signalling apparatus on tramcars and the like." R. Heaton. February 21st.

4,463. "Incandescent electric lamps." A. A. Barron. February 21st.

4,472. "Electricity prepayment meters." British Insulated and Helsby Cables, Ltd., and L. B. Wilson. February 21st.

4,479. "Electrically-heated cooking and like utensils." J. Mann. February 21st. (Complete.)

4,499. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) February 21st. (Complete.)

4,502. "Telephone attachment." N. Marx. February 21st.

4,507. "Starting switches and the like for alternating-current induction motors." Siemens Bros. Dynamo Works, Ltd., and C. Rodgers. February 21st.

4,508. "Ignition systems." C. F. Kettering. (Convention date, March 4th, 1912, United States.) February 21st. (Complete.)

4,514. "Aerial conductors for use in wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd, and C. S. Franklin. February 21st.

4,528. "Telephonic apparatus." H. W. Sullivan and C. E. Hay. February 22nd.

4,543. "Electrically-driven secondary clocks." H. Haycock and T. Sampson. February 22nd.

4,548. "Sparking plugs for internal combustion engines." W. Douglas (trading as Douglas Bros.). February 22nd.

4,573. "Electrical instruments." P. W. Scholefield and Ferranti, Ltd. February 22nd.

4,584. "Selective electric signalling." H. H. Harrison and C. M. Jacobs. February 22nd.

4,591. "Automatic electrical switches." Electric Sign Co., Ltd., and W. K. L. Dickson. February 22nd. (Complete.)

4,595. "Magnetic separator." F. Krupp Akt-Ges. Grusonwerk. (Convention date, March 15th, 1912, Germany.) February 22nd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Electrostatic Machines for the Production of Alternating Current. W. Petersen. 2,442. January 30th.

Electric Incandescent Lamps. British Thomson-Houston Co. (General Electric Co.) 2,468. January 30th.

Electric Alarm Device for Measuring Instruments. S. Worliczka and M. Sluzar. 2,517. January 31st.

Means for, and Methods of, Charging and Discharging Electric Accumulators or Secondary Batteries. A. M. Taylor. 2,680. February 1st. (Cognate application, No. 12,884 of 1912.)

Automatic and Semi-automatic Telephone Circuits. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 2,671. February 1st.

Automatic and Semi-automatic Telephone Circuits. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 2,672. February 1st. (Addition to No. 2,820 of 1912.)

Self-excited Direct-Current Dynamo-electric Machinery. Akt.-Ges. Brown, Boveri & Cie. 2,734. February 2nd. (February 24th, 1911.)

Automatic and Semi-automatic Telephone Circuits. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 2,743. February 2nd. (Addition to No. 2,820 of 1912.)

Starting Gear for Internal-combustion Engines and other Prime Movers. H. Leitner. 2,746. February 2nd.

Incandescence Electric Lamps. A. W. Beuttell and J. A. Manners-Smith. 3,099. February 7th.

Electric Arc Lamps. Crompton & Co. and C. Crompton. 8,397. February 10th.

Electricity Meters. S. Z. de Ferranti. 3,412. February 10th.

Apparatus for Providing Electric Light on Motor Road Vehicles. T. Clarkson and W. J. Morison. 4,716. February 26th.

Electric Incandescent Lamps. C. F. Stillman. 4,783. February 26th.

Coupling-up of Conduits and Fittings for Electrical Wiring Purposes. F. L. Yates. 6,146. March 1st.

Safety Apparatus for Electrically-propelled Trains. Siemens Bros. Dynamo Works, Ltd., and F. Lydall. 6,922. March 20th.

Electro-mechanical Transmission Systems for Vehicles. H. Pieper. 7,133. March 23rd. (April 29th, 1911.)

Sparking Plugs for Internal-combustion Engines. M. Riesz. 8,206. April 4th. (April 5th, 1911.)

Manufacture by Electrolysis of Sheet-iron. G. Tischenko. 8,668. April 12th.

Electric Cigar-Lighters. L. T. Dixon. 8,677. April 12th.

Manufacture of Foot Step or Insulator Bracket for Telegraph and Like Poles. H. Lench. 10,600. May 4th. (Cognate application, No. 17,453 of 1912.)

Processes of Repairing Electric Incandescent Lamps. M. Du Moulin. 12,784. May 30th.

Electro-mechanical Propulsion Systems for Trains. H. Pieper. 13,233. June 5th. (June 27th, 1911.)

Self-contained Key Panel for Semi-automatic Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 13,415. June 7th.

Electro-medical Electrodes. Siemens & Halske Akt.-Ges. 13,416. June 7th. (August 29th, 1911.)

Electrodes for Arc Lamps. British Thomson-Houston Co. (General Electric Co.) 13,488. June 15th.

Methods of Drawing Fine Wires of Refractory Metals. K. Farkas. 14,654. June 22nd. (June 23rd, 1911.)

Combined Electric Switches and Plugs. A. H. Railing and C. C. Garrard. 14,785. June 25th.

Process for the Manufacture of Iron Alloys for Dynamo-electric Purposes. W. Rubel. 15,532. July 3rd. (July 11th, 1911. Addition to No. 12,483 of 1911.)

Switches for Electric Wiring Systems. L. Milne. 16,065. July 9th.

Brackets or Pendants for Gas, Electric and other Lighting Purposes. H. Perry. 16,119. July 10th.

Electrically-heated Hot-air Douches. A. Schaeffer. 20,191. September 4th. (December 23rd, 1911.)

Electric Furnaces for Producing Gas Reactions. H. Pauling. 21,478. September 20th. (October 24th, 1911.)

Portable Electrically-driven Centrifugal Fans. S. C. Davidson. 22,049. September 27th.

Radiator Lampholders.—In the course of a very long letter, received too late for use last week, Mr. G. St. John Day, of Oldham, says:—Experience has proved that a screw lampholder is far from satisfying the requirements of the application. The troubles are not confined to the lampholders, but relate also to the lamps and the design of the radiator. Each individual part has its failings, and when fitted together the whole appliance has faults, and these individual and collective faults vary in degree with makers, contractors and users.

The foregoing remarks are equally applicable to other types of lampholders such as B.C., two-pin and central contact lampholders. The cleaner, larger, and firmer are contacts, joints, &c., the better; the best conditions then prevail and yield the best results. There is a vast field of opportunity for a better state of electrical accessories in many ways. Does the design of electrical accessories compare favourably with the design of steam, water and gas accessories?

Some of the correspondents have mentioned the Mumps lampholder as a solution of the matter. As the designer and patentee of the Mumps lampholder I simply state a few facts:—

A. A current of 10 amperes at 440 volts has been passed through a Mumps holder and plug in connection for 18 hours continuously without heating or breaking down of insulation.

B. The insulation of the Mumps holder is unique and extra strong.

C. The adjustable range of contact is not only new, but most desirable and effective.

D. Life of lamps increased.

E. More light for same watts.

F. Maintenance costs reduced.

G. Hard and spring contact at one and the same time.

H. Complete security and rigidity of both mechanical and electrical joints unaffected by vibration.

An Everlasting "Auriga" Lamp.—In a letter recently received by the British Westinghouse Electric and Manufacturing Co., Ltd., the writer says: "You will be interested to know that one of the "Auriga" metal-filament lamps, 50 c.p., 220 volts, which we bought from you in February, 1910, is still burning, and has been in use continually since that date, averaging at least 18 hours per day for the three years, thus burning practically 20,000 hours. The filament is quite intact—not having been 'joined across.'"

This is the highest record that has yet come to our notice.